SYSTEMATICS AND ZOOGEOGRAPHY OF *PLAGIOLA* (= *DYSNOMIA* = *EPIOBLASMA*), AN ALMOST EXTINCT GENUS OF FRESHWATER MUSSELS (BIVALVIA: UNIONIDAE) FROM MIDDLE NORTH AMERICA.

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CONTENTS

Abstract. *Plagiola* (= *Dysnomia* = *Epioblasma*), a genus of Unionidae (Mollusca: Bivalvia) is unique among all freshwater mussels in the extent of sexual dimorphism found among its members. The 17 species recognized here are assigned to 3 subgenera. All but one species, found in the Mobile-Alabama-Coosa river system in Alabama, occur in the Tennessee River system, and that species is clearly derived from one in the latter system. Fourteen of the species are also found in the Cumberland River system. Three of these fourteen are also found in the White River system on the Ozark Plateau in Missouri and Arkansas. These three species, as well as a number of other similarly distributed unionids, afford evidence of a

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relict fauna that may have persisted since the Cretaceous. The post-glacial distribution of several of the species that have found their way beyond the Tennessee and Cumberland river systems suggests that all the species are of Cumberlandian origin.

INTRODUCTION

Among the numerous genera of Unionidae, *Plagiola* is one of the more interesting because of the extent and variety of sexual dimorphism among the 17 species belonging to 5 subgenera. Many of the species vary but slightly, though several have numerous ecophenotypic varients. Some forms, formerly recognized as valid species or subspecies, could not be properly dealt with before the biological species concept was defined. This paper attempts to clarify the synonymy of the species of *Plagiola* and to reconstruct what was, until a short time ago, their distribution. To do this, most specimens in the principal museums were examined. These records are supplemented with some only available in the literature. Almost a dozen of the species are now considered extinct or endangered from pollution, or because their habitats have been, or are being, destroyed by impoundments.

BACKGROUND

The members of *Plagiola* were first monographed and separated from *Unio* by Simpson (1900a: 524), who placed them in the genus *Truncilla* Rafinesque 1820. His designation of *Truncilla triqueter* Rafinesque as the type was invalid, since *Truncilla truncata* Rafinesque had previously been designated as the type by Herrmannsen (1849, 2: 627). Therefore, Ortmann and Walker (1922: 65) designated *Dysnomia* Agassiz 1852 as the next available generic taxon, whose type species was *Unio foliatus* Hildreth (= [*Obliquaria*] *flexuosa* Rafinesque) by subsequent designation (Simpson 1900a: 521). They made this designation since they regarded the type species of both *Plagiola* Rafinesque 1820 (*Obliquaria* (*Plagiola*) *interrupta* Rafinesque) and *Epioblasma* Rafinesque 1831 (*E. biloba* Rafinesque) as unidentifiable, though Frierson (1914) had previously asserted that *biloba* was the female of *foliatus* Hildreth. Thiele (1934), Clench (1959), Morrison (1969) and Stansbery (1973), used *Epioblasma* over *Dysnomia*. Stansbery (pers. com.) assured me that he can recognize *biloba*. To settle this matter, a neotype was chosen for it here, see p. 283. However, Johnson and Baker's (1973:159) selection of a lectotype for *Obliquaria* (*Plagiola*) *interrupta* Rafinesque, which Morrison (1969) had previously asserted as identifiable, makes *Plagiola* the earliest available generic taxon, with *Epioblasma* (=*Dysnomia*) as a subgenus.

These nomenclatorial changes are unfortunate, but we now have *Rules of International Nomenclature* (1964), not available to Ortmann and Walker, which emphasize the identification of the type. As Stansbery (pers. com.) has said, "Ortmann and Walker (1922) did a fine job for their time in consideration of their basic premise that the validity of a name depends upon its identifiability from the original description. I consider the identification of the holotype (if extant) to be the court of last appeal in such matters. If we did not, most of Lamarck's [unionid] names now in use would become *nomina dubia*."

The most recent revision of the *Rules* [1974. Bull. Zool. Nomencl. *31* (2): 80] under Article 23 states, "A zoologist who considers that the application of the Law of Priority would in his judgment disturb stability or universality or cause confusion is to maintain the existing usage and must refer the case to the Commission for a decision under the plenary powers [Art. 79]."

It is hoped that in this paper, the identity of the specific taxa of *Plagiola* are settled. It is unfortunate that some of these identifications also result in changes on the generic and subgeneric level. However, Morrison (1969) declared *Plagiola* available over *Dysnomia*, and Stansbery has used *Epioblasma* over *Dysnomia* numerous times

in the literature. Since this author is not sure what *is* existing usage in *Plagiola*, this paper is written on the assumption that the Law of Priority has not been totally abrogated.

Simpson (1900a: 516–524) recognized four subgenera within this genus. Ortmann and Walker (1922: 65) created monotypic *Truncillopsis*, based on the former's studies of the very primitive anatomy of *triquetra*. Frierson (1927: 93–96) added three additional subgenera. These were based entirely on conchological characters, merely by selecting a type species for each, without explanation. In spite of this method, two of his subgenera are recognized here, *viz. Plagiola* Rafinesque s. s. [=*Penita* Frierson] and *Torulosa* Frierson [=*Capsaeformis* Frierson].

Walker (1910) constructed an excellent key to the species, as he conceived them. Simpson (1914) augmented his previous arrangement (1900a) with species descriptions. Haas (1969: 477–490), in *Das Tierreich*, wrote on *Dysnomia* [=*Plagiola*]. His subgeneric and specific concepts are those of Frierson, and his descriptions appear to be essentially German translations of Simpson (1914: 2–32). Haas's work is a compilation of the literature on this genus to 1927. Burch (1973, 1975) included the species as recognized by Simpson in a general key to the North American Unionacean clams.

RELEVANT FAUNAL STUDIES

The unionid fauna of the upper Tennessee River system was commented on by Coker (1912), studied extensively by Ortmann (1918), and reexamined by Stansbery (1973) and Stansbery and Clench (1975). The lower Tennessee, below Walden Gorge, to the Muscle Shoals in Lauderdale and Colbert counties, Alabama, was extensively studied by Ortmann (1925) and augmented with notes by van der Schalie (1939b). Morrison (1942) compared the fauna found in the Indian mounds near the Muscle Shoals with the present fauna in the river. Isom (1968) and Isom and Yokley (1968) enumerated the unios of Indian Creek and Bear Creek tributaries of the Tennessee in Alabama. Duck River, a tributary of the lower Tennessee, was carefully studied by Ortmann (1924a), restudied by Isom and Yokley (1968) and re-restudied by van der Schalie (1973).

The Cumberland River unionids were studied by Wilson and Clark (1914). Those of the upper part of the river were examined again, between 1947–49, by Neel and Allen (1964) before the completion of the Wolf Creek Dam.

Studies have been made of the unionid faunas of many of the rivers flowing into the southern side of the Ohio River beyond the Cumberland. These are presented in a west to east arrangement.

The unios of the Tradewater River were listed by Clench and van der Schalie (1944); those of the Green were extensively studied by Ortmann (1926). The Green River species were again listed by Clench and van der Schalie (1944), who also included the Salt River unionids in their paper. The Salt River unionids were listed again by Rosewater (1959). The unionids of the Kentucky River were studied by Danglade (1922), and Ortmann (1913: 290) discussed the species found in the upper Ohio drainage.

Relevant studies of the Ohio River unionids and of those rivers flowing into it on the northern side are presented in a west to east arrangement. The unionid fauna of Kansas was studied by Scammon (1906) and again by Murray and Leonard (1962). Utterback (1915–16) studied that of Missouri, and recently Buchanan (ca. 1976) studied that of the Meramec River basin in the same state. Baker (1928) wrote on the unionids of Wisconsin. Parmalee (1967), in a popular paper on the Unionidae of Illinois, included data on *Plagiola*, as did Starrett (1971) in his work on the Unionacea of the Illinois River. Stein (1881) enumerated the mollusca of Indiana; these were

monographed by Call (1900). Call's work was supplemented by Blatchley and Daniels (1903) and Daniels (1915). The Indiana mollusca were subsequently revised by Goodrich and van der Schalie (1944). Meyer (1974) studied the unionid fauna of the Wabash and White rivers in Indiana, and Clark (1976) examined the unionids of the lower Wabash River. Baker (1922) had previously studied the molluscan fauna of the Big Vermilion River, a large tributary of the Wabash. Goodrich (1932) wrote a handbook on the mollusca of Michigan and included data on *Plagiola*. La Rocque (1967) compiled a work on the Unionidae of Ohio.

Wilson and Clark (1912b) reported on the extensive collection of naiades they made in the Maumee River drainage, which is tributary to Lake Erie. Clark (1977) wrote on the naiades of the St. Joseph River of the Maumee. Ortmann (1924b) in a paper on the distributional features of the naiades in the tributaries of Lake Erie, discussed the post-glacial dispersal of the species, as did Goodrich and van der Schalie (1932), who studied the unionids of the Great Lakes. The post-glacial dispersal of unionids to Lake Erie was again reviewed by Stansbery (1961).

Van der Schalie made further contributions to the understanding of post-glacial dispersion in his papers on the unionid faunas of the Muskegon, Grand (*both* 1941a), St. Joseph (1936) and Huron (1938a) river drainages in Michigan. In a paper discussing the value of mussel distribution in tracing stream confluence, van der Schalie (1945) summarized the data about the post-glacial dispersal of the Unionidae.

The unionid fauna of several drainages of the Mobile-Alabama-Coosa river system have been studied. The unionids of the Cahaba and Tombigbee rivers were examined by van der Schalie (1938b, 1939a), and those of the Coosa River by Hurd (1974).

ZOOGEOGRAPHY

General Considerations

It should be mentioned to the reader unfamiliar with the means of dispersal of the Unionidae, that their mobility is passive—dependent on fishes to which the larval forms, or glochidea, attach themselves for a period of time. Stream capture, and subsequent rupturing of confluences, have therefore played a significant role in determining the geographic distribution of the Unionidae.

The Tennessee and Cumberland river systems are among the world's most ancient. The Tennessee, containing at least 86 species of Unionacea, has the largest assemblage of unionid species found anywhere, followed by the Cumberland River, which has a unionid fauna of at least 78 species.

Ortmann (1924a: 40) recognized among the Unionidae two distinct faunal elements in these two river systems—those belonging to the Interior Basin and found in the Ohio River drainage, and those not found outside the Tennessee and Cumberland river systems. (There are a few exceptions that also occur on the Ozark Plateau). This latter group of species is restricted largely to the Cumberland Plateau and to the Great Allegheny Valley. This area represents the Cumberlandian Region, defined by Ortmann (1924a: 40) as including only the drainages of the Tennessee River system from the headwaters to the vicinity of Muscle Shoals, in Colbert and Lauderdale counties, Alabama; and the Cumberland River system from the headwaters to the vicinity of Clarksville, Montgomery County, Tennessee (Ortmann, 1925: 366). Ortmann (1924a: 40) also discussed the unionid fauna of the Duck River drainage, which is at present a tributary of the Tennessee River system. The upper portion of the Duck River has a fauna that is 38 per cent Cumberlandian, and Ortmann suggested that this was the original fauna and that there had been stream confluence with the

Duck and both the Tennessee and Cumberland river systems long ago.

The distribution of the old Interior Basin fauna in the Tennessee and Cumberland river systems indicates that most of it was present in these rivers, along with the even more ancient Cumberlandian fauna, long before maximum Pleistocene glaciation (which occurred early in the epoch and extended southward roughly to the present Missouri and Ohio rivers). Apparently many members of the former fauna, and some of the latter, repopulated at least the present Ohio and upper St. Lawrence river systems from these sources. Some of the species may also have had refugia elsewhere, as in the Allegheny and Monongahela rivers in Pennsylvania (Ortmann, 1912b).

Originally Ortmann (1924a: 40) regarded as Cumberlandian only those unionid species currently confined to the areas of the Tennessee and Cumberland river systems, as defined above. Later (1925: 370) he suggested there were Cumberlandian species that descended the Tennessee and Cumberland river systems and invaded the Ohio River drainage and the Interior Basin.

Distribution of *Plagiola* below the area Maximum Glaciation

All of the species of *Plagiola*, with the exception of *penita* from the Mobile-Alabama-Coosa river system in Alabama, occur in the Tennessee River system, and only two of these, *torulosa* (Plate 3) and *sampsoni* (Plate 6, fig. B) are missing in the Cumberland River system.

Three species, *triquetra* (Plate 1), *turgidula* and *florentina* (*both* Plate 2), are found not only in the Tennessee and Cumberland river systems, but also in the White River system in Missouri and Arkansas, south of the Ozark Crest, where they may have persisted since before the Cretaceous uplift. One of these species, *triquetra*, is also found north of the Ozark Crest in the Meramec River, Missouri, and in tributaries of the present Missouri River in Kansas.

Another species, *Cumberlandia monodonta* (Say), of the family Margaritiferidae, is found in both the Tennessee and Cumberland river systems and north of the Ozark Crest in the Osage and Gasconade rivers in Missouri. Like *triquetra*, it appears to have had refugia here from glacial destruction. The members of *Cyprogenia* and a number of other unionid species have the same restricted distribution as *florentina* and *turgidula*, but they are beyond the scope of this paper.

Seven species of *Plagiola*—*interrupta* (Plate 7, fig. A), *capsaeformis* (Plate 7, fig. B), *lenior* (Plate 7, fig. C), *haysiana* (Plate 8, fig. A), *arcaeformis* (Plate 8, fig. B), *stewardsoni* (Plate 8, fig. C) and *biemarginata* (Plate 9, fig. A)—are found in both the Tennessee and Cumberland river systems exclusively.

Plagiola penita of the Mobile-Alabama-Coosa river system is derived from *interrupta* of the Tennessee River system. Hayes and Campbell (1894) suggested that the upper Tennessee River formerly flowed through Walden Gorge into the Gulf of Mexico by way of the present Mobile-Alabama-Coosa river system, and that it was diverted to its present course through the Cumberland Plateau in the late Tertiary. Their conclusions, based entirely on physiographic evidence such as the character of the Tennessee-Coosa divide, were substantiated by Simpson (1900b) on the basis of similarities in the unionid faunas of the present river systems.

Johnson (1905) effectively defeated all support for the river capture theory of Hayes and Campbell. The upper Tennessee appears to have held the same course since the close of the Cretaceous. However, "where the smaller tributaries of the Coosa and Tennessee rivers have common divides in the carbonate rocks of the Appalachian Valley, it is highly probable that many captures have occurred and effected the faunal transfers which have been formerly attributed to the Walden Gorge capture." (Hurd, 1974: 137).

Post-glacial Distribution of *Plagiola*

Maximum Pleistocene glaciation occurred early in the epoch, and extended southward to roughly the present Missouri and Ohio rivers. Much of the unionid fauna found on the Cumberland Plateau is the same as that found on the Ozark Plateau, and it is assumed that the latter area was as an important source for the species that repopulated the Mississippi drainage (above the Missouri), as was the former in the repopulation of the Ohio drainage. Ortmann (1913: 351) observed that the unionid fauna of the Ohio River is more numerous downstream. There are some 60 species in the vicinity of Cincinnati, Hamilton County, Ohio, decreasing to 47 species in Pennsylvania. Ortmann suggested that this fauna migrated upstream in glacial and post-glacial time when the present Ohio River was formed. The unionid fauna of the larger tributaries of the Ohio River drainage in Kentucky, beyond the limit of glaciation, is Ohioan. From west to east, the tributaries are: the Tradewater with 17 species, the Green with 50 species, the Salt with 22 species (*all* Clench and van der Schalie, 1944), the Kentucky with 40 species (Danglade, 1922), the Licking with 14 species and the Big Sandy with 12 (*both* Ortmann, 1913).

Plagiola triquetra is the only member of the genus found in the Mississippi River drainage. While it may have spread there from the Ohio River, it is just as likely that it spread from a refugium in the Meramec River system, Missouri. In any event, the present distribution of *triquetra* in Wisconsin clearly illustrates van der Schalie's (1945: 336) suggestion that a connection existed in post-glacial time between the Fox and Wisconsin rivers at Portage, Columbia County, Wisconsin (Plate 1, A).

The presence of *triquetra* in the Illinois River, Illinois, and in the Muskegon, Grand and St. Joseph rivers, on the eastern side of Lake Michigan in the St. Lawrence drainage, supports van der Schalie's (1945: 356) suggestion that before the formation of Lake Michigan the latter rivers were tributaries of the Des Plaines River, which by way of the Chicago outlet, drained into the Mississippi River (Plate 1, B). Although *torulosa* is not currently found in the Mississippi River drainage, the species probably reached the Grand River by the same route as that taken by *triquetra* (Plate 3). If it ever occurred in the Cumberland River system, it now appears to be missing.

It is assumed that *triquetra* spread into the Ohio River system from the Tennessee and Cumberland river systems, though it might have also had refugia in the Allegheny and Monongahela river drainages in western Pennsylvania (Ortmann, 1912b), Fig. 1). The distribution of *triquetra* as well as *torulosa* and *obliquata* in the St. Lawrence River system indicates a former connection between the Wabash and Maumee rivers in the vicinity of Fort Wayne, Allen County, Indiana (Plate 1, C, Plate 3, Plate 4). Like *triquetra*, *torulosa* might have had refugia in western Pennsylvania.

The present distribution of *triquetra*, *torulosa* and *obliquata* in the rivers flowing into Lake Erie also indicates the correctness of Ortmann's (1924b) and van der Schalie's (1945: 362) view that during the Trent Outlet stage of the Great Lakes, when Lake Erie was partially dry, many of the present rivers flowing into western Lake Erie were part of the Greater Maumee River system.

Three species, *flexuosa* (Plate 5), *personata* (Plate 6, fig. A), and *propinqua* (Plate 6, fig. B) have spread from the Tennessee and Cumberland river systems into the Wabash River drainage and the Ohio River. An additional species, *sampsoni* (Plate 6, fig. B), missing from the Cumberland River, has a restricted post-glacial distribution similar to *flexuosa* and *personata*.

OBSERVATIONS AND CONCLUSIONS

1. There are 17 species of *Plagiola*; all but one occur in the Tennessee River system. *P. penita* of the Mobile-Alabama-

Coosa river system is clearly derived from *P. interrupta* and provides evidence of a former confluence between the two river systems in the past.

2. The Cumberland River system has 14 of the 16 species found in the Tennessee River system, lacking only *P. torulosa* and *sampsoni*. Obviously, there has been stream confluence between these ancient river systems.

3. There are six species of *Plagiola* in the upper Duck River drainage of the Tennessee River system; only one, *P. triquetra*, is found outside the Tennessee or Cumberland river systems. Ortmann (1924a: 46), on the basis of this and much more data, suggested that Duck River was originally more directly connected with the Tennessee and Cumberland rivers.

4. Two species of *Plagiola*, *turgidula* and *florentina*, occur only in the upper Tennessee and Cumberland river systems and in the upper White River system south of the Ozark Crest in Missouri. The presence of these species in the latter system as well as *P. triquetra* and several other unionid species (not discussed in this paper), strongly suggests that a number of species have persisted since the Cretaceous uplift.

5. Seven species of *Plagiola*, found in the Tennessee River system, have spread into the formerly glaciated area. Two of these, *P. triquetra* and *torulosa*, may have had Pleistocene refugia in the Allegheny and Monongahela river drainages in the mountainous region of western Pennsylvania. *Plagiola torulosa* and *sampsoni* do not occur in the Cumberland River system. Thus only five species of *Plagiola: triquetra*, *propinqua*, *personata*, *obliquata* and *flexuosa*, may have spread into the once glaciated area from the Cumberland River system.

6. The present distribution of *P. triquetra* in Wisconsin suggests that a connection once existed in post-glacial time between the Fox and Wisconsin rivers at Portage, Columbia County, Wisconsin.

7. The present distribution of *P. triquetra* —in the Illinois River, Illinois, and the Muskegon, Grand (as well as *torulosa* in the latter) and St. Joseph rivers on the eastern side of Lake Michigan in Michigan—indicates that before the formation of Lake Michigan, the latter streams were tributaries of the Des Plaines River, which drained into the Mississippi River by way of the Chicago outlet.

8. The present distribution of *P. triquetra*, *torulosa* and *obliquata* in the St. Lawrence River system indicates that a connection formerly existed in post-glacial time between the Wabash and Maumee rivers in the vicinity of Fort Wayne, Allen County, Indiana.

9. The present distribution of *P. triquetra*, *torulosa* and *obliquata* in the rivers flowing into western and southern Lake Erie indicates that during the Trent Outlet stage of the Great Lakes, when the bed of Lake Erie was partially dry, these rivers were part of the Greater Maumee River system.

10. The most primitive species of *Plagiola*, *triquetra*, appears to be the most abundant as well as the most widely distributed species in the genus. Interestingly, the shells exhibit little morphological variation.

11. Following *Plagiola triquetra*, the most widely distributed species in the genus are *torulosa* and *obliquata*, in that order. The shells of *torulosa* exhibit considerable ecophenotypic variation depending on their environment, while those of *obliquata* show almost no such variation.

12. Three species of *Plagiola*, *arcaeformis*, *stewardiana* and *biemarginata*, appear to be the least abundant as well as the least widely distributed species in the genus. The shells exhibit little morphological variation. All three species are now considered extinct.

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SYSTEMATIC SECTION

Abbreviations. The following abbreviations have been used in the text and on the plate captions:

ANSP	Academy of Natural Sciences of Philadelphia, Pennsylvania
BMNH	British Museum (Natural History), London, England
CM	Carnegie Museum, Pittsburgh, Pennsylvania
MCZ	Museum of Comparative Zoology, Cambridge, Massachusetts
MZUM	Museum of Zoology, University of Michigan, Ann Arbor, Michigan
OSM	Ohio State Museum, Columbus, Ohio
USNM	National Museum of Natural History, Washington, D. C.

Synonymy. For ease of reference, full citations are included for each taxon, including the type locality and the location of the type when known. References to plates and figures are not included under Lea's Obs. Unio since they are always the same as in the preceding entry. In some instances, lectotypes are selected. Elsewhere in the text, references are abbreviated and require the use of the bibliography. Except for the original references, only relevant citations since 1914 are included here since the earlier ones are available in Simpson (1914).

Descriptions. The measurements are only intended to convey the general size of specimens from a given station, and to indicate sexual differences.

Anatomy and Breeding Season. The available data are cited.

Habitat. Included when known.

Remarks. These are designed to elucidate the differences between the sexes and the species, and include comments on distribution and taxonomy.

Range. The distribution is summarized.

Abundance. The former abundance of the species is based on the number and size of the lots found in the several collections studied. Their present abundance is based on the opinions of Stansbery (1970, 1971, 1976).

Specimens Examined. Most of the records are based on the specimens in the collections mentioned above. These collections contain almost all specimens available for study, and with the exception of the small collection in the Ohio State Museum, all have been personally examined. The records are followed by the initials of the institution in which they were observed. In most instances when records were duplicated only references to the specimens in the Museum of Comparative Zoology were included, though in certain critical cases several references are mentioned. Specimens not seen are credited to the responsible individual or published reference and to the associated institution, if it is known. The published references may be found either under *Synonymy* or under *Literature Cited*, or sometimes under both headings.

Distribution. The various river systems are listed from west to east. East of the Mississippi River this arrangement approxi-

mates the direction of post-glacial dispersal. The records from each river system are arranged from the headwaters to the mouth, with the exception of the Ohio River drainage, which is oppositely arranged to indicate the post-glacial distribution of most species from the Tennessee and Cumberland river systems.

The cumbersome term, Mobile-Alabama-Coosa river system, is used because it reflects the main channel of the river, which was given a different name at each important confluence.

Figures. When available, holotypes, allotypes and lectotypes are generally used to illustrate each species. Where required, several illustrations are included to show ecophenotypic variation. Not included are the pencil sketches of the new species described by the Sicilian nobleman, Marchese A. De Gregorio (1914), who, with abandon, began redescribing the unionids of North America. Some of the data on the plate captions, such as the measurements, are not repeated elsewhere.

The distributional maps are based on Rand McNally and Company's *Commercial Atlas of America* 1912 Edition, plate 21, which indicates United States Inland Waterways.

Key to the Subgenera of *Plagiola*

Because of the pronounced sexual dimorphism occurring in *Plagiola*, this key to the subgenera consists of one section for each sex. The keys to the species in the several subgenera are constructed without special regard for sexual differences. Anyone unfamiliar with this genus should refer to Burch's "Key" (1973 or 1975).

Males

1. Shell with a distinct radial furrow in front of the posterior ridge 2
   Shell without a distinct radial furrow in front of the posterior ridge 4
2. Radial furrow narrow and shallow ..... *Pilea*
   Radial furrow wide and of varying depth 3
3. Shell subrhomboid or subquadrate ..... *Epioblasma*
   Shell oval, obovate, elliptical, subquadrate or trapezoid ..... *Torulosa*
4. Shell long based triangular ..... *Truncillopsis*
   Shell subquadrate, subrhomboid, or elliptical ..... *Plagiola*

Females

1. Marsupial expansion occupying part of the posterior or medial region 2
   Marsupial expansion occupying the entire postbasal region ..... *Torulosa*
2. Marsupial expansion formed by a swelling of the posterior ridge 3
   Marsupial expansion formed by a swelling in front of the posterior ridge and more or less separated from it 4
3. Shell distinctly long based triangular, marsupial swelling not extending below the base line, with conspicuous green rays and mottling ..... *Truncillopsis*
   Shell subquadrate or subrhomboid, marsupial swelling usually extending below the base line, usually with fine green rays that are often broken by growth rests ..... *Plagiola*
4. Marsupial area located medially and extending below the base line as a distinct lobe ..... *Epioblasma*
   Marsupial area in front of the posterior ridge, often separated from it by a narrow sulcus, not extending below the base line ..... *Pilea*

Superfamily **UNIONACEA** Thiele 1935
Family UNIONIDAE (Fleming 1828) Ortmann 1911
Subfamily LAMPSILINAE (Ihering 1901) Ortmann 1910
Genus *Plagiola* Rafinesque

Plagiola Rafinesque 1819, Jour. Phys. Chim. Hist. Nat. (Paris) 88: 426. Species listed: *verrucosa, fasciolaris, leptodon, depressa, flava, obliquatas* [sic], *all* Rafinesque, *all nomina nuda*; 1820, Ann. Gén. des Sci. Physiques, Bruxelles 5: 302. Species listed: *Obliquaria decorticata, O. interrupta, O. depressa, O. lineolata, all* Rafinesque. Type species, *Unio interruptus* Rafinesque 1820, subsequent designation, Herrmannsen, 1847, Indicis Generum Malacozoorum 2: 279.

Penita Frierson 1927, Check list N American naiades, pp. 11, 93. Type species, *Unio penitus* Conrad, original designation, *teste* Errata et Corrigenda.

Description. The most interesting character of *Plagiola* is the remarkable difference between the shells of the male and female. The shells are essentially alike until about one-third to one-half grown, when the development of marsupial swelling begins in the female. This marsupial swelling,

in the post-ventral region, is thinner than the rest of the shell and is often of a somewhat different texture; it may take the form of a widely rounded wing, or be marked off from the rest of the shell by sulci. The swelling is often radially sculptured and toothed at the edge, with remains of the teeth visible along the growth lines. In many species the male has a radial depression in front of the posterior ridge. The shape of the shell is variable, but is generally subovate or subtriangular and is somewhat inflated. The shell is either not sculptured or only covered with low tubercles. The umbonal sculpture is delicate and faintly doubly looped. The periostracum is yellowish or greenish, generally with some green rays.

Anatomy. Discussed by Ortmann (1912a: 354), Simpson (1914: 2) and Utterback (1916: 452 [189]).

The selection of a lectotype for *Obliquaria* (*Plagiola*) *interrupta* Rafinesque 1820 by Johnson and Baker (1973: 159) and its acceptance in this paper over *Unio brevidens* Lea 1831 requires that the species, formerly under the genus *Dysnomia* or *Epioblasma*, be placed in *Plagiola*. This use of *Plagiola* was indicated by Morrison (1969: 24).

Ortmann and Walker (1922: 51) regarded *O.* (*P.*) *interrupta* Rafinesque as unidentifiable and designated *O.* (*P.*) *lineolata* Rafinesque = *securis* Lea as the type species of *Plagiola*. This apparently made *Dysnomia* Agassiz 1852 available. See under remarks to subgenus *Epioblasma*.

Baker (1964: 140) pointed out that whether or not *interrupta* was identifiable, Ortmann and Walker's subsequent designation of *lineolata* as type species was invalid, and that *lineolata* belonged in the genus *Ellipsaria* Rafinesque, the synonymy of which follows:

Ellipsaria Rafinesque 1820, Ann. Gén. des Sci. Physiques, Bruxelles 5: 303. Type species, *Obliquaria ellipsaria* Rafinesque, by tautonymy. Ortmann and Walker (1922: 52) agreed that this taxon is a synonym of *lineolata*. Their conclusion was confirmed by Johnson and Baker (1973: 154, pl. 5, fig. 1), who selected a specimen identified by Rafinesque as neotype.

Crenodonta Schlüter 1838, Kurzgefasstes systematisches Verzeichness meiner Conchyliensammlung . . . . (Halle), p. 33. Species listed: *plicata* Say, *tuberculata* Rafinesque, *securis* Deshayes [=Lea], *trigona* Lea. Type species, *Crenodonta securia* (Deshayes) [=Lea], subsequent designation, Herrmannsen, 1852, Indicis Generum Malacozoorum, Supplementa et Corrigenda, p. 38.

Plagiolopsis Thiele, 1934, Handb. syst. Weichtierk. 3: 834. Type species, *P. securis* (Lea), monotypic.

Thiele concluded that *Plagiola* was equivalent to *Lampsilis* Rafinesque and, unaware of either *Ellipsaria* Rafinesque or *Crenodonta* Schlüter, created an unnecessary taxon.

Ellipsaria is monotypic, and is represented by *E. lineolata* Rafinesque 1820.

Subgenus *Truncillopsis* Ortmann and Walker

Truncillopsis Ortmann and Walker 1922, Occ. Papers, Mus. Zool., Univ. Mich. no. 112, p. 65. Type species, *Truncilla triqueter* Rafinesque, original designation.

Description. Shell long based triangular, covered with conspicuous green rays and mottling, greatly inflated, sharply truncated posteriorly. Disk smooth without any radial furrow. Female with a slight marsupial swelling at the posterior ridge ending at the extreme post-ventral point.

Anatomy. Discussed by Ortmann (1912a: 355), who regarded this monotypic subgenus as the most primitive member of the genus in which the typical features of the genus are barely indicated.

Plagiola (*Truncillopsis*) *triquetra* (Rafinesque)

Plate 10, figures 1–4
Distribution: Plate 1

Truncilla triqueter Rafinesque 1820, Ann. Gén. Sci. Physiques, Bruxelles 5: 300, pl. 81, figs. 1–4 (chutes de l'Ohio [River, near Louisville, Jefferson Co., Kentucky]; lectotype ANSP 20231 selected by Johnson and Baker, 1973, Proc. Acad. Nat. Sci. Phila. 125: 173, pl. 7, fig. 3).

Unio triangularis Barnes 1823, American Jour. Sci. 6: 272, pl. 13, fig. 17, a, b (Detroit River [Michigan]; Bois Blanc Isle [Essex Co., Ontario], figured type Lyceum of Natural History of New York [destroyed by fire]).

Unio cuneatus Swainson 1823, Philos. Mag. Jour., Edinburgh 61: 112 (no locality; type [lost]).

Unio formosus Lea 1831, Trans. Amer. Philos. Soc. 4: 111, pl. 16, fig. 41 (Ohio River; type not in the USNM or ANSP [lost]); 1834, Obs. Unio 1: 121.

Unio triangularis pergibosus Gregorio 1914, Il Nat. Siciliano 22: 40, pl. 4, fig. 4 (Sciota [Scioto] River, Ohio, type presumed to be in Palermo Mus., Sicily [not seen]).

Unio triangularis longiusculus Gregorio 1914, Il Nat. Siciliano 22: 40, pl. 4, fig. 5 (Sciota [Scioto] River, Ohio, type presumed to be in Palermo Mus., Sicily [not seen]).

Truncilla (*Truncilla*) *triquetra* (Rafinesque). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 517; 1914, Cat. Naiades 1: 6.

Truncilla triquetra (Rafinesque). Ortmann 1909, Ann. Carnegie Mus. 5: 118; 1912a, Ann. Carnegie Mus. 8: 355. Wilson and Clark 1912, U. S. Bur. Fisheries, Doc. 757: 55; 1914, U. S. Bur. Fisheries, Doc. 781: 45. Ortmann 1918, Proc. Amer. Philos. Soc. 57: 585; 1919, Mem. Carnegie Mus. 8: 325, pl. 21, figs. 3, 4.

Dysnomia (*Truncillopsis*) *triquetra* (Rafinesque). Ortmann and Walker, 1922, Occ. Papers, Mus. Zool. Univ. Mich., no. 112: 65. Ortmann, 1925, Amer. Mid. Nat. 9: 359. Frierson, 1927, Check list N. American naiades, p. 96. Baker, 1928, Bull. Univ. Wisconsin, no. 1327, p. 296, pl. 86, figs. 5–7, pl. 70, figs. 4–7. La Rocque, 1967, Geol. Surv. Ohio, Bull. 62 (2): 285, fig. 176. Haas, 1969, Das Tierreich, pt. 88, p. 479.

Dysnomia triquetra (Rafinesque). Danglade, 1922, U. S. Bur. Fisheries, Doc. 934, p. 5. Ortmann, 1926, Ann. Carnegie Mus. 17: 182. van der Schalie, 1941, Jour. of Conch. 21: 251. Morrison, 1942, Bur. Amer. Ethnology, no. 129, p. 363. Goodrich and van der Schalie, 1944, Amer. Mid. Nat. 32: 314. Robertson and Blakeslee, 1948, Bull. Buffalo Soc. Nat. Sci. 19: 112, pl. 11, fig. 9. Murray and Leonard, 1962, Univ. Kansas, Mus. Nat. Hist., Misc. Pub. 28, p. 155, pl. 44, figs. 1–4, text fig. 40. Neel and Allen, 1964, Malacologia 1: 450, fig. 63. Starrett, 1971, Illinois Nat. Hist. Surv. Bull. 30: 340, pl. 4, fig. 21. Clarke, 1973, Mal. Review 6: 64.

Description. Shell usually of medium size, reaching up to 80 mm in length. Outline long based triangular. Valves slightly inequilateral, much inflated, solid. Anterior end regularly rounded, posterior end obliquely truncated. Ventral margin slightly curved in males, almost straight in females. Dorsal margin short, almost straight, forming a distinct angle with the obliquely descending posterior margin. Hinge ligament short. Posterior ridge, high, faintly double, sharply angled. Dorsal slope very broad, slightly concave and radially sculptured. Umbos full and high, turned inward and anteriorly over a well-marked lunule, located slightly anterior of the middle of the shell; their sculpture is faint consisting of broken, somewhat doubly-looped ridges. Surface of the shell smooth except for numerous irregular growth rests. Periostracum subshiny, tawny to yellow green, with broken bright green rays and rows of green mottling.

Left valve with two ragged, subcompressed, triangular, pseudocardinal teeth; no interdentum. Two short, straight, elevated, granular lateral teeth. Right valve with two subcompressed, triangular, pseudocardinal teeth. One lateral tooth. Anterior adductor muscle teeth well impressed, posterior ones less so. Pallial line impressed anteriorly. Umbonal cavities deep. Nacre white or silvery.

Male shells grow larger, and are somewhat less sharply triangular than those of the female.

Female shells have a marsupial swelling in the area of the posterior ridge consisting of a slightly elevated, narrowly rounded, radially sculptured ridge that projects just below the ventral margin.

Length mm	Height mm	Width mm	
78	52	45	Little Miami River, Ohio. Male.
46	33	25	Green River, 8 mi. S Campbellsville, Taylor Co., Kentucky. Male.
40	24	22	As above. Female.

Anatomy and Breeding Season. The anatomy was discussed by Ortmann (1912a: 355), who also (1919: 327) determined that the species is bradytictic.

Habitat. Found in riffles with stony and sandy bottoms, in swift currents, usually deeply buried (Baker, 1928: 298).

Remarks. *Plagiola triquetra* (Rafinesque) does not closely resemble any other member of the genus *Plagiola*. It may be distinguished by its long triangular outline, sharply truncated posterior end and rows of green mottling. It might be confused with two other unionids, *Truncilla truncata* Rafinesque or *Alasmidonta marginata* Say, since both have somewhat superficial resemblances to *triquetra*. *T. truncata* is more triangular, with a sharper posterior ridge and a concave dorsal margin, and *A. marginata* lacks distinct pseudocardinal teeth and has no lateral teeth.

Range. Upper White River system, Missouri; Missouri River drainage, Kansas and Missouri; Mississippi River system, Wisconsin and Iowa; Illinois River drainage, Illinois; Tennessee and Cumberland River systems; Green River drainage, Kentucky; Ohio River system from Indiana to Pennsylvania; St. Lawrence River system: Lakes Michigan and Erie.

Reported in Oklahoma by Simpson (1914: 6) but not by Isely (1925).

Abundance. This is the most successful member of the genus in that it is the most widely distributed and most generally abundant. It occupies more of the formerly glaciated region than any other *Plagiola*.

Specimens Examined

White River System

Black River Drainage. *Missouri*: [Black River], Poplar Bluff, [Butler Co.]. (MZUM 81269. This important record, based on a single specimen, has the locality written on the shell, with the additional data [W. A.] Marsh, March 3, 1891).

Mississippi River System

Meramec River Drainage. *Missouri*: Bourbeuse River, 5 mi. S Owensville, Gasconade Co. (MCZ). Meramec and Big rivers (Buchanan [collection sites shown on map, but not listed]).

Osage River Drainage. *Kansas*: Marais des Cygnes River, Ottawa, Franklin Co. (Scammon).

Missouri River Drainage. *Kansas*: Wakarusa River, Lawrence, Douglas Co. (Scammon).

Mississippi River Drainage. *Wisconsin*: Wisconsin River, Sauk Co. (MZUM). *Iowa*: Mississippi River, Davenport, Scott Co.; Mississippi River, Muscatine, Muscatine Co. (*both* MCZ).

Illinois River Drainage. *Illinois*: Kankakee River (Parmalee, 1967). Illinois River, La Salle, La Salle Co.; Illinois River, Fulton Co. (*both* Starrett).

Tennessee River System

Powell River Drainage. *Tennessee*: Powell River, Shawanee, Claiborne Co. (CM).

Clinch River Drainage. *Virginia*: Clinch River, St. Paul, Wise Co.; Clinch River, Dungannon and 1.5 mi. below Speers Ferry bridge, *both* Scott Co.; Clinch River, 1.5 mi. S Dona, Lee Co. (*all* MCZ). *Tennessee*: Clinch River below Kyles Ford bridge, Hancock Co.; Clinch River, 4 mi NW Thorn Hill, Grainger Co.; Clinch River, Clinton, Anderson Co.; (*all* MCZ).

Holston River Drainage. *Virginia*: North Fork, Mendota, Washington Co.; South Fork, Pactolus, Sullivan Co. (*both* CM). *Tennessee*: Holston River, Rogersville, Hawkins Co.; mouth of Holston River, Austins Grist Mill, Knox Co. (*both* MCZ).

French Broad River Drainage. *Tennessee*: Nolichucky River, Chunns Shoals, Hamblen Co. (CM).

Tennessee River Drainage. *Tennessee*: Tennessee River, Knoxville, Knox Co. (MCZ).

Paint Rock River Drainage. *Alabama*: Paint Rock River, Paint Rock, Jackson Co. (CM).

Flint River Drainage. *Alabama*: Flint River, Maysville, Madison Co. (CM).

Elk River Drainage. *Tennessee*: Elk River, Fayetteville, Lincoln Co. (MCZ).

Tennessee River Drainage. *Alabama*: Tennessee River, Muscle Shoals, between

Colbert and Lauderdale Cos. (CM). Not found by Morrison (1942: 363) in the Pickwick Basin mounds.

Bear Creek Drainage. *Alabama*: Bear Creek, Burleson, Franklin Co. (CM).

Duck River Drainage. *Tennessee*: Duck River, Wilhoite, Marshall Co.; Duck River, Hardinsons Mill, Maury Co., 12 mi. NW Lewisburg, Marshall Co.; Duck River, Columbia, Maury Co. (*all* MCZ).

Cumberland River System

Cumberland River Drainage. *Kentucky*: Beaver Creek, E Rowena Ferry, Russell Co. (MCZ). *Tennessee*: Cumberland River, Goodall Island, Smith Co. (Wilson and Clark).

Obey River Drainage. *Tennessee*: Obey River, Duncan Ford, 4 mi. SE Lilydale, Pickett Co. (MCZ); Obey River, Celina, Clay Co. (Wilson and Clark).

Cumberland River Drainage. *Tennessee*: Cumberland River, Nashville, Davidson Co. (MCZ).

Ohio River System

Wabash River Drainage. *Illinois*: Little Wabash River, Wayne Co. (MCZ). *Indiana*: West Fork, White River, Indianapolis, Marion Co.; White River, Rockford, Jackson Co. (*both* MCZ). *Ohio*: Big Beaver Creek (CM); Wabash River, Recovery; *both* Mercer Co. (MCZ). *Indiana*: Salmonia River, Grant Co.; Wabash River, Lafayette, Tippecanoe Co. (*both* MCZ).

Green River Drainage. *Kentucky*: Green River, 8 mi. S Campbellsville, Taylor Co.; Green River, Greensburg, Green Co.; Green River, Rio and Munfordville, *both* Hart Co.; Green River, Mammoth Cave, Edmondson Co.; West Fork, Drakes Creek, Massey Mill, Warren Co.; (*all* MCZ).

Salt River Drainage. *Kentucky*: Rolling Fork, Salt River, Raywick, Marion Co. (MCZ).

Ohio River Drainage. *Kentucky*: Falls of the Ohio River, near Louisville, Jefferson Co. (Rafinesque). *Ohio*: Ohio River, Cincinnati, Hamilton Co. (MCZ).

Miami River Drainage. *Ohio*: Little Miami River (MCZ); Miami River (CM).

Scioto River Drainage. *Ohio*: Olentangy River, Delaware, Delaware Co.; Scioto River, Columbus, Franklin Co.; Big Darby Creek, 4 mi. S Orient; Scioto River, Circleville; *both* Pickaway Co. (*all* MCZ).

Little Kanawha River Drainage. *West Virginia*: Little Kanawha River, Burnsville, Braxton Co.; Little Kanawha River, Grantsville, Calhoun Co.; North Fork, Hughes River, Cornwallis, Richie Co. (*all* CM).

Muskingum River Drainage. *Ohio*: Tuscarawas River, New Philadelphia, Tuscarawas Co.; Mohican River, above confluence with Kolosing River, Newcastle Twp., Coshocton Co. (*both* MCZ).

Ohio River Drainage. *Ohio*: Ohio River, Stubenville, Jefferson Co. (MCZ).

Big Beaver River Drainage. *Ohio*: Mahoning River, near Garretsville, Portage Co. (MCZ). *Pennsylvania*: Shenango River, Shenango; Pymatuning, Pymatuning Township, *both* Mercer Co. (*both* CM).

Allegheny River Drainage. *Pennsylvania*: Leboeuf Creek, Erie Co.; Conneaut Outlet, Crawford Co.; French Creek, Venango Co. (*all* CM); Allegheny River, Kelly and Aladdin, *both* Armstrong Co. (*both* CM).

Monongahela River Drainage. *West Virginia*: West Fork River, Lightburn, Lewis Co.; West Fork River, Lynch Mines, Harrison Co. (*both* CM). *Pennsylvania*: Dunkards Creek, Mt. Morris, Greene Co. (MCZ).

St. Lawrence River System

Great Lakes Drainage. (Lake Michigan) *Wisconsin*: Fox River, Omro, Winnebago Co. (Baker). *Michigan*: St. Joseph River, 2 mi. S Leonidas, St. Joseph Co. (MZUM); Grand River, Grand Rapids, Kent Co. (MCZ); Muskegon River, 3 mi. below Newaygo, Newaygo Co. (MZUM). (Lake Huron) *Michigan*: Lake Huron (Goodrich, 1932). (Lake Erie) *Ontario*: Sydenham River, 1.8 mi. NE Shetland, Lamberton Co. (Clarke). *Michi-*

gan: Lake St. Clair (Goodrich, 1932). *Ontario*: Bois Blanc Isle, Essex Co. (Barnes); Lake Erie, Rondeau Bay, Kent Co. (MCZ). *Michigan*: Huron River, 1 mi. S Milford, Oakland Co.; Huron River, E Buck Lake, Livingston Co.; Huron River, Rockwood; Lake Erie, La Plaisance Bay; *both* Monroe Co. (*all* MZUM). *Ohio*: Auglaize River (MCZ). Swan Creek, Toledo, Lucas Co. (CM). Lake Erie, Put-in Island, Ottawa Co. (Wilson and Clark). Sandusky River, Fremont, Sandusky Co. (CM). Grand River, Painsville, Lake Co. (MCZ). *Pennsylvania*: Lake Erie, Presque Isle Bay, Erie, Erie Co. (CM).

Subgenus *Plagiola* s. s. Rafinesque

Type species, *Unio interruptus* Rafinesque 1820; subsequent designation, Herrmannsen 1847, 1: 279.

Description. Shell subquadrate, subrhomboid, or elliptical somewhat truncated posteriorly. Male smooth on the disk without any radial furrow. Female with a marsupial swelling in front of the post basal point; swelling may or may not extend below the ventral margin, but it is marked by two distinct sulci.

KEY TO THE SPECIES OF *PLAGIOLA* S. S.

1. Shell not much inflated, marsupial swelling extending below the base 2
   Shell greatly inflated, marsupial swelling not extending below the base ..... *arcaeformis*
2. Shell moderately thick, rays generally broken, sometimes not rayed 3
   Shell very thin and delicate with fine green rays ..... *lenior*
3. Posterior slope acutely angled, from the Mobile-Alabama-Coosa river system ..... *penita*
   Posterior slope not acutely angled, from the Tennessee or Cumberland river systems ..... *interrupta*

Plagiola (*Plagiola*) *interrupta* (Rafinesque) Plate 10, figures 5–7 Distribution: Plate 7, figure A

Obliquaria (*Plagiola*) *interrupta* Rafinesque 1820, Ann. Gén. Sci. Physiques, Bruxelles 5: 320 (le Kentuky et Ohio [Rivers]. Lectotype ANSP 20257, selected by Johnson and Baker, 1973, Proc. Acad. Nat. Sci. Phila. 125: 159, pl. 7, fig. 4 and the type locality restricted to the Cumberland River).

Unio brevidens Lea 1831, Trans. Amer. Philos. Soc. 4: 75, pl. 6, fig. 6 (Ohio; Cumberland River, Tennessee [*teste* errata sheet]; figured type [lost]; male and female specimens, subsequently identified by Lea, USNM 85349). 1834, Obs. Unio 1: 85.

Unio interruptus (Rafinesque). Conrad, 1834, New Fresh Water Shells U. S., p. 69; 1838, Monography Unionidae, no. 10, p. 88, pl. 48.

Truncilla brevidens (Lea). Simpson, 1900, Proc. U. S. Natl. Mus., 22: 517; 1914, Cat. Naiades 1: 7. Wilson and Clark, 1914, U. S. Bur. Fisheries Doc. no. 781: 45.

Truncilla interrupta (Rafinesque). Ortmann, 1918, Proc. Amer. Philos. Soc. 57: 586.

Dysnomia (*Truncillopsis*) *brevidens* (Lea). Ortmann and Walker, 1922, Occ. Papers, Mus. Zool., Univ. Mich. no. 112, p. 66. Ortmann, 1925, Amer. Midland Nat. 9: 360.

Dysnomia (*Penita*) *brevidens* (Lea). Frierson, 1927, Check list N American naiades, p. 94. Haas, 1969, Das Tierreich, pt. 88, p. 482.

Dysnomia brevidens (Lea). Morrison, 1942, Bur. Amer. Ethnology, Bull. no. 129, p. 363. Neel and Allen, 1969, Malacologia 1: 448, figs. 59–62.

Description. Shell of medium size, reaching over 80 mm in length, though often not exceeding 50 mm in length. Outline of male rhomboid or subtriangular; of female subquadrate. Valves somewhat inequilateral; males not much inflated; females greatly inflated, especially old individuals; solid. Anterior end regularly rounded; posterior one more broadly rounded. Ventral margin slightly curved. Dorsal margin of male straight, forming an obtuse angle with the obliquely descending posterior margin. Dorsal margin of female broadly curved merging imperceptably with the rounded posterior margin. Hinge ligament prominent. Posterior ridge broadly curved and faintly double in the male; the posterior ridge of the female becomes a rather sharply elevated marsupial swelling, toothed below and marked with the remains of former teeth, separated from the rest of the shell by two distinct sulci. It often projects well below the base and has a semicircular outline on it. Dorsal slope flat, broad, sometimes with radial sculpture. Umbos much elevated, elongated, located

anteriorly, their sculpture consisting of feeble, double looped bars. Surface of the disk smooth or clothlike. Periostracum yellowish, tawny, or tawny brown, with narrow, broken, radial green rays, sometimes broken into large dots, especially posteriorly.

Left valve with two ragged pseudocardinal teeth, triangular, and of about equal size; the anterior tooth narrow, straight, directed obliquely forward slightly widening toward the anterior end; the posterior tooth triangular; the space between them triangular and extending to the hinge. Interdentum very short and narrow. Two nearly straight, very short, heavy, obliquely sculptured lateral teeth. Right valve with two pseudocardinal teeth, the anterior tooth small and parallel with the hinge, the posterior tooth long, high, parallel to the anterior one, separated from the interdentum by a deep pit. One well-developed lateral tooth, often with a parallel vestigial tooth below it. Umbonal cavities very shallow. Anterior and posterior adductor muscle scars well impressed, pallial line distinct. The marsupial area of the female has a rounded radial furrow. Nacre white.

Male shells are rhomboid or subtriangular in outline, moderately inflated, and flattened on the disk.

Female shells are subquadrate, rounded behind, and greatly inflated. When about one-third grown the marsupial swelling becomes sharply elevated, and decidedly separated from the rest of the shell by two distinct sulci.

Length mm	Height mm	Width mm	
70	54	37	Cumberland River, Tennessee. Male.
64	49	42	As above. Female.

Habitat. The species appears to occur in moderate-sized, clear streams with a rocky bottom, avoiding the smaller tributaries. (Wilson and Clark, 1914: 45).

Remarks. Male shells of *Plagiola interrupta* (Rafinesque) can usually be separated from the shells of the other members of the subgenus *Plagiola* s. s. by the tendency of the green rays, which are often present on the entire surface, to be broken into dots. In *P. lenior* the rays are confined to the posterior region and are not broken. The shell of *interrupta* is rhomboid, subtriangular or subquadrate in outline, whereas that of *lenior* is elliptical; both are flattened on the disk, but the latter is smaller, and has a thin, delicate shell. *P. interrupta* is easily separated from *P. arcaeformis*, as the latter is always much more inflated, has a stronger posterior ridge, and a characteristic emarginate posterior margin.

Female shells of *P. interrupta* resemble those of *arcaeformis* except the latter's shells are much more inflated. The sulci of *interrupta* are much more acute, and while its marsupial swelling extends below the base, the swelling in *arcaeformis* does not; instead the base is remarkably flattened. *P. lenior* has a marsupial swelling similar to that of *interrupta*, but the former has such a thin, delicate, small shell it is unlikely to be mistaken for the latter.

Old, mature specimens of both sexes of *P. interrupta* from the Cumberland River, and the Holston River of the Tennessee River system, closely resemble those of *penita* of similar maturity from the Mobile-Alabama-Coosa river system, but they can be separated morphologically. In general, the male of *interrupta* is more rhomboid and flatter on the disk than is *penita*, and the former is covered with green rays which are broken into dots. In both sexes, if rayed at all, those of *penita* are more delicate and any dots are finer. Females of *interrupta* differ from those of *penita* in that the marsupial swelling is marked by two acute sulci, whereas the posterior one in *penita* is obscure or absent, and the dorsal slope of the latter is much more oblique.

The taxa *interrupta* and *brevidens* have both been used for this species. Say (1834: no. 6 [no pagination]) and Conrad (1834: 69 and 1838, no. 10, p. 88, pl. 48) recognized *interrupta* Rafinesque; however,

Simpson (1900a: 517; 1914: 7) did not. Ortmann and Walker (1922: 66) argued *interrupta* could not be recognized from the original description; Frierson (1927: 79) insisted *interrupta* is *Lampsilis menkiana* (Lea) 1836; and Morrison (1969: 24) asserted that *Obliquaria* (*Plagiola*) *interrupta* Rafinesque 1820 = *Unio brevidens* Lea 1831. The present emphasis on the identification of the type as the final criterion in determining the availability of a taxon requires that Rafinesque's name be recognized.

Range. Tennessee River system, Virginia, Tennessee and Alabama; Cumberland River system, Kentucky and Tennessee.

Abundance. The number of specimens in the collections studied indicate this species must once have been relatively abundant. It is considered "threatened" by Stansbery (1976: 43, 49).

Specimens Examined

Tennessee River System

Powell River Drainage. *Virginia*: Powell River, 2.5 mi. S and 7 mi. SW, Jonesville, *both* Lee Co. (*both* MCZ). *Tennessee*: Powell River, 8–10 mi. N Tazwell, Claiborne Co.; Powell River [town of] Powell River, Campbell Co. (*both* MCZ).

Clinch River Drainage. *Virginia*: Clinch River, Hill Station, 5.5 mi. below Fort Blackmore, Scott Co.; Station Creek, Lee Co. (*both* MCZ). *Tennessee*: Clinch River, below Kyles Ford bridge, Clinch River, Sneedsville, *both* Hancock Co. (*both* MCZ); Clinch River, Clinton, Clinch River, Edgmoor, *both* Anderson Co. (*both* MCZ).

Holston River Drainage. *Tennessee*: Holston River, Austins Grist Mill, Knox Co. (MCZ).

French Broad River Drainage. *Tennessee*. Nolichucky River (MCZ).

Tennessee River Drainage. *Tennessee*: Tennessee River, Knoxville, Knox Co. (MCZ).

Elk River Drainage. *Tennessee*: Lower Elk River (Conrad); Elk River, 4 mi. ESE Fayetteville, Lincoln Co. (MCZ).

Tennessee River Drainage. *Alabama*: Tennessee River, Muscle Shoals, Colbert and Lauderdale Cos. (CM, MZUM); Tennessee River, Tuscumbia, Colbert Co. (MCZ); Pickwick Basin, mounds between Barton, Colbert Co. and Waterloo, Lauderdale Co. (Morrison, USNM).

Duck River Drainage. *Tennessee*: Duck River, Wilhoite, Marshall Co. (MZUM, CM); Duck River, Hardinsons Mill, Mauray Co., 12 mi. NW Lewisburg, Marshall Co. (MCZ); Duck River, Columbia, Mauray Co. (Hinkley and Marsh).

Cumberland River System

Cumberland River Drainage. *Kentucky*: Cumberland River, Burnside (MCZ); Big South Fork, opposite Parkers Lake Station (Wilson and Clark); *both* Pulaski Co.; Beaver Creek, E Rowena Ferry, Russell Co. (MCZ).

Caney Fork Drainage. *Tennessee*: Caney Fork, Putnam Co. (Wilson and Clark).

Stones River Drainage. *Tennessee*: Stones River, Murfreesboro, Rutherford Co; Stones River, 1.2 mi. W Couchville, Davidson Co.; (both MCZ).

Cumberland River Drainage. *Tennessee*: Cumberland River, Nashville, Davidson Co. (USNM).

Plagiola (*Plagiola*) *penita* (Conrad)

Plate 10, figures 8–15

Distribution: Plate 9, figure B

Unio penitus Conrad 1834, New fresh water shells United States p. 33, pl. 5, fig. 1 (Alabama River, near Claiborne [Monroe Co.], Alabama; figured holotype ANSP 59860).

Unio metastriatus Conrad 1838, Monography Unionidae, no. 11 [back cover]; 1840, *Ibid.*, no. 12, p. 104, pl. 57, fig. 2 (Black Warrior River, Blounts Springs, [Blount Co.], Alabama; figured types [lost]).

Unio othcaloogensis Lea 1857, Proc. Acad. Nat. Sci. Phila. 9: 32 (Othealooga [Oothkalooga] Creek, Gordon Co., Georgia); 1858, Jour. Acad. Nat. Sci. Phila. (2) 4: 74, pl. 14, fig. 54, figured holotype USNM 84615; 1858, Obs. Unio 6: 74.

Unio compactus Lea. 1859, Proc. Acad. Nat. Sci. Phila. 11: 154 (Etowah River; Conasauga River; *both* Georgia); 1859, Jour. Acad. Nat. Sci. Phila. (2) 4: 218, pl. 28, fig. 98, figured holotype USNM 84447 from the former locality; 1859, Obs. Unio 7: 36.

Unio modicellus Lea 1859, Proc. Acad. Nat. Sci. Phila. 11: 171 (Conasauga River; Chattanooga [=Chattooga] River; *both* Georgia); 1860, Jour. Acad. Nat. Sci. Phila. (2) 4: 347, pl. 57, fig. 172, figured holotype USNM 84841 from the former locality; 1860, Obs. Unio 8: 29.

Truncilla penita (Conrad). Simpson 1900, Proc. U. S. Natl. Mus. 22: 518; 1914, Cat. Naiades 1: 8.

Dysnomia (*Penita*) *penita* (Conrad). Frierson, 1927, Check list N American naiades, p. 93; Haas, 1969, Das Tierreich, pt. 88, p. 481; Hurd, 1974, Ph. D. thesis, p. 97.

Epioblasma penita (Conrad). Stansbery, 1976, Bull. Alabama Mus. Nat. Hist., no. 2: 43, 48, fig. on p. 49.

Truncilla metastriata (Conrad). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 519; 1914, Cat. Naiades 1: 10.

Dysnomia (*Penita*) *metastriata* (Conrad). Frierson, 1927, Check list N American naiades, p. 93. Haas, 1969, Das Tierreich, pt. 88, p. 482. van der Schalie, 1938, Occ. Papers Mus. Zool., Univ. Mich., no. 392, p. 16; 1939, *Ibid.*, no. 407, p. 4; Hurd, 1974, Ph. D. thesis, p. 95.

Truncilla othcaloogensis (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 521; 1914, Cat. Naiades 1: 17.

Dysnomia (*Penita*) *othcaloogensis* (Lea). Frierson, 1914, Check list N American naiades, p. 94. Haas, 1969, Das Tierreich, pt. 88, p. 484. van der Schalie, 1938, Occ. Papers, Mus. Zool., Univ. Michigan, no. 392, p. 16. Hurd, 1974, Ph. D. thesis, p. 96.

Truncilla compacta (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 518; 1914, Cat. Naiades 1: 9.

Truncilla modicella (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 518; 1914, Cat. Naiades 1: 11.

Dysnomia (*Penita*) *modicella* (Lea). 1927, Check list N American naiades, p. 94. Haas, 1969, Das Tierreich, pt. 88, p. 484.

Description. Shell of medium size reaching 60 mm in length. Outline of male rhomboid or subtriangular, of female subrhomboid or quadrate. Valves somewhat inequilateral, males usually moderately inflated, females considerably inflated, solid. Anterior end regularly rounded, posterior end more broadly rounded. Ventral margin slightly curved. Dorsal margin of male straight, forming an obtuse angle with the obliquely descending posterior margin. Dorsal margin of female broadly curved merging imperceptably with the rounded posterior margin. Hinge ligament prominent. Posterior ridge broadly curved, sometimes quite imperceptable in the male. When about one-half grown, the posterior ridge of the female often becomes a rather sharply-elevated, narrow, rounded marsupial swelling, often slightly toothed below, and sometimes marked with the remains of former teeth, separated from the anterior of the shell by a sulcus. The marsupial swelling often projects below the base line, and when it does is rather long and has a semicircular outline on it. Dorsal slope flat and narrow, sometimes with radial sculpture. Umbos much elevated, located anteriorly, their sculpture not observed. Surface of the disk smooth. Periostracum yellowish, tawny, or tawny brown, often with broken radial green lines, sometimes broken into inconspicuous dots, arrowhead markings or darker color arranged radially on the posterior part.

Left valve with two ragged pseudocardinal teeth, triangular and of about equal size; the anterior tooth is narrow, straight, directed obliquely forward, slightly widening toward the anterior end; the posterior tooth is triangular, the space between them is triangular and extending to the hinge. Interdentum very short and narrow. Two nearly straight, short, heavy, obliquely sculptured lateral teeth. Right valve with two pseudocardinal teeth, the anterior tooth small, parallel to the hinge, the posterior tooth long, high, parallel to the anterior one, separated from the interdentum by a deep pit. One well-developed lateral tooth often with a parallel vestigial tooth below. Umbonal cavities very shallow. Anterior and posterior muscle scars well impressed, pallial line distinct. The marsupial area of the female showing a rounded radial furrow. Nacre white, or bluish white.

Male shells are rhomboid or subtriangular in outline, and moderately inflated.

Female shells are subrhomboid or quadrate, subtruncated behind and often greatly inflated. When about one-third grown the marsupial area becomes swollen and elevated, separated from the anterior part of the shell by a distinct sulcus.

Length mm	Height mm	Width mm	
25	19	13	Conasauga River, 4.3 mi. W Eton, Murray Co., Georgia. Male.
21	15	11.5	As above. Female.
58	42	36	Alabama River, Selma, Autauga Co., Alabama. Male.
45	25	25	As above. Female.

Remarks. Plagiola penita (Conrad) of the Mobile-Alabama-Coosa river system resembles *P. interrupta* of the Tennessee and Cumberland river systems. Males of the former are, in general, more quadrate, or proportionally higher than those of *interrupta*. *P. penita* remain quadrate, or subtriangular, throughout their range though specimens from the upper reaches of the Coosa River drainage do not grow very large and are often rayless. *P. interrupta* from the upper reaches of headwater streams become rather more rhomboid and flattened on the disk than specimens from elsewhere, though still growing up to 50 mm in length and exhibiting distinct green rays broken into dots.

Females of *P. penita* and *interrupta*, from those habitats where each reach their maximum size, rather closely resemble one another; the marsupial swelling of both is marked from the disk by an anterior sulcus, while the latter also has a sharp posterior sulcus that is slight, or lacking, in *penita*. *P. penita* has a posterior margin that slopes more obliquely than that of *interrupta*; this renders the dorsal slope of the former much narrower. Females of *penita* from the upper reaches of the Coosa River drainage are usually small, rayless, and appear barely to reach sexual maturity. These were recognized as *othcaloogensis* by Hurd (1974: 96) who followed the usage of authors since Simpson (1914: 8). The localities of the lots, included under this taxon by Hurd, in the Museum of Comparative Zoology, are with their catalogue numbers, since the latter are the only data given by him. (See under Specimens Examined.) Simpson (1914: 9) recognized *compactus* (included with *modicellus* under *othcaloogensis* by Hurd), and noted that female shells are generally, though not always, shorter than those of *penita*; that they are rather narrower and more compressed in front, and that the posterior end is somewhat evenly rounded instead of being obliquely truncate. Simpson (1914: 10) suggested that *U. metastriatus* Conrad was nothing more than a variety of *compactus*, in which case the later taxon would have priority. The former was recognized as a valid species by Hurd (1974: 95). Stansbery (1976: 49) recognized both *metastriata* and *penita* as valid and said of the latter, "This species is very similar to, yet distinct from *Epioblasma metastriata*," without further elucidation.

The female shells of *penita* are variable as to the extent of the marsupial swelling. Variation in the amount of inflation of the valves occurs in both sexes. Specimens from the larger rivers tend to attain greater size, are more inflated and are more often rayed than those occurring in smaller headwater streams. In the latter, shells are small, not greatly inflated, almost always rayless and with a smooth yellow periostracum. When rayed at all, those of *penita* are narrower and more delicate than those of *interrupta* from the Tennessee and Cumberland river systems. When the rays of the former are broken into dots, they are much finer than those of *interrupta*.

Van der Schalie (1938a: 27) noted that no *Dysnomia* [*Plagiola*] occur in the river systems on either side of the Mobile-Alabama-Coosa river system and correctly suggested that it, and a number of other genera, arrived there through a former confluence with the Tennessee River system.

Range. Mobile-Alabama-Coosa river system, Georgia, Alabama, and Mississippi.

Abundance. The number of specimens in the collections studied indicate this species must have been relatively abundant. Hurd (1974: 170–180), during 1971–73, made an extensive survey of the Coosa River drainage for Unionidae. He collected at 194 stations but found only 28 specimens of *Plagiola* from four localities, all of which he regarded as *othcaloogensis* (pp. 42, 96). Stansbery (1976: 43, 48, 49) lists *othcaloogensis* and *penita* as having an "endangered status" and *metastriata* as having a "threatened status."

Specimens Examined

Mobile-Alabama-Coosa River System

Conasauga River Drainage. *Georgia*: Conasauga River, Beaverdale, Whitfield Co. (MCZ 200353); Conasauga River, Upper Kings Bridge (MCZ 933788); Conasauga River, Lower Kings Bridge (MCZ); Conasauga River, 4.3 mi. W Eton (MCZ 36620 & 214237); *all* Murray Co. Conasauga River, Fikes Ford, 1.4 mi. N Resaca, Gordon Co. (MCZ).

Oothkalooga Creek Drainage. *Georgia*: Oothkalooga Creek, Gordon Co. (Lea, USNM).

Oostanaula River Drainage. *Georgia*: Oostanaula River, Rome, Floyd Co. (MCZ).

Etowah River Drainage. *Georgia*: Etowah River, Rome, Floyd Co. (MCZ).

Chattooga River Drainage. *Georgia*: Chattooga River (MCZ 16348, 16532, 28711, 28809).

Coosa River Drainage. *Alabama*: Mill Creek (MCZ 51518, 16444); Coosa River, Stackland (MCZ); *both* Cherokee Co. Coosa River, Gadsden, Etowah Co. (MCZ). Coosa River, old lock 5, 6 mi. SW, Lincoln; Coosa River, Fort William Shoals; *both* Talladega Co. Coosa River, Weduska Shoals and Three Island Shoals, *both* Shelby Co. Coosa River, Wetumpka, Elmore Co. (*all* MCZ).

Cahaba River Drainage. *Alabama*: Cahaba River, Henry Ellen, Lovick, Grants Mill, and E. Merkel, *all* Jefferson Co. (*all* MZUM); Buck Creek, Helena (MCZ, MZUM); Cahaba River, Nunley Ford (MZUM); *both* Shelby Co.; Cahaba River, Lily Shoals (MCZ), and 10 mi. above Centerville (MZUM), *both* Bibb Co.; Cahaba River, 8 mi. N Sprott, and 5 mi. NE Marion, *both* Perry Co. (*both* MZUM).

Alabama River Drainage. *Alabama*: Alabama River, Selma, Dallas Co. (MCZ); Alabama River, near Claiborne, Monroe Co. (Conrad).

Black Warrior River Drainage. *Alabama*: Black Warrior River, Blounts Springs, Blount Co. (Conrad); Black Warrior River, Squaw Shoals, Jefferson Co.; Black Warrior River, Tuscaloosa Co. (*both* MCZ);

Tombigbee River Drainage. *Mississippi*: East Fork Tombigbee River, 3 mi. W Smithville, Monroe Co. (OSM, MCZ). *Alabama*: Tombigbee River, Epes, Sumter Co. (MZUM).

Plagiola (*Plagiola*) *arcaeformis* (Lea)

Plate 11, figures 1–4

Distribution: Plate 8, figure B

Unio arcaeformis Lea 1831, Trans. Amer. Philos. Soc. 4: 116, pl. 17, fig. 44 (Tennessee River; figured type [lost], male and female specimens subsequently identified by Lea USNM 84422); 1834, Obs. 1: 126.

Unio nexus Say 1831, Transylvania Jour. Medicine 4: 527 (Cumberland River, Nashville [Davidson Co.], Tennessee); 1834, Amer. Conch., no. 6, pl. 51, figured type [lost].

Truncilla arcaeformis (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 519; 1914, Cat. Naiades 1: 12. Wilson and Clark, 1914, U. S. Bur. Fisheries Doc. 781, p. 46. Ortmann, 1918, Proc. Amer. Philos. Soc. 57: 586.

Dysnomia (*Truncillopsis*) *arcaeformis* (Lea). Ortmann, 1925, Amer. Mid. Nat. 9: 359.

Dysnomia (*Penita*) *arcaeformis* (Lea). Frierson, 1927, Check list N American naiades, p. 94. Haas, 1969, Das Tierreich, pt. 88, p. 482.

Dysnomia arcaeformis (Lea). Morrison, 1942, Bur. Amer. Ethnology Bull. 129, p. 363. Stansbery, 1970, Malacologia 10: 19, pl. 1, figs. 5, 6; 1971, Symposium of rare and endangered Moll. U. S., p. 18a, figs. 1–2.

Description. Shell of medium size, reaching 70 mm in length. Outline of shell sub-

quadrate or subrhomboid. Valves inequilateral, greatly inflated, females especially so, solid. Anterior end regularly rounded; posterior end more broadly rounded. Ventral margin slightly curved in males, with a slight emargination before the posterior ridge; quite straight in females. Dorsal margin straight forming an obtuse angle with the obliquely descending, emarginate, posterior margin. Hinge ligament prominent. Posterior ridge full, high, double or triple, subangulate, subtruncate behind the ridge. When about half grown the posterior ridge of the female becomes a marsupial swelling, slightly toothed below, marked with faint tooth sculpture at rest lines and with faint radial sculpture, separated from the rest of the shell by two distinct but broad sulci. Marsupium much flattened below, does not project below the base which is remarkably flattened. On the dorsal slope above the upper posterior ridge is usually a shallow radial furrow. Umbos full, much elevated, almost touching one another, located anteriorly, their sculpture consisting of undulating ridges. Surface of the shell smooth, or cloth-like. Periostracum tawny to yellowish-green, usually with delicate green rays over the entire surface.

Left valve with two ragged pseudocardinal teeth, triangular, and of about equal size, the space between them triangular and extending to the hinge. Interdentum very short and narrow. Two nearly straight, very short, heavy, obliquely sculptured lateral teeth. Right valve with one large pseudocardinal tooth, sometimes with a smaller tooth before or behind it. When present, the anterior tooth is small and parallel with the hinge. The pit before the interdentum is deep. One well-developed lateral tooth, sometimes with a vestigial tooth below. Umbonal cavities moderately deep. Anterior and posterior adductor muscle scars well impressed. Pallial line distinct. The marsupial area of the female is much thinner than the surrounding shell and has a rounded radial furrow. Nacre white.

Length mm	Height mm	Width mm	
52	40	38	Cumberland River, Tennessee. Male.
70	48	64	Tennessee River, Tennessee. Female.

Remarks. Plagiola arcaeformis (Lea) may be distinguished from any other member of the genus by the extreme inflation of both the male and female shells, by the radial furrow above the posterior ridge and by the emarginate posterior margin.

Both male and female shells are considerably alike in outline, though the latter are less elevated and more inflated. Old females are extraordinarily inflated. The marsupial swelling is considerably inflated toward the base, but is remarkably flattened so that it scarcely projects below the base.

Young males of *arcaeformis* might possibly be mistaken for *P. turgidula,* except the latter is not as high or inflated and has a shallow radial furrow below rather than above the posterior ridge.

Range. Tennessee River system, Tennessee and Alabama; Cumberland River system, Kentucky and Tennessee.

Abundance. Generally not found in great numbers, but reported to be locally abundant in the Holston River drainage of the Tennessee River system by Ortmann (1918: 586). "The entire range of this species is now under a series of impoundments. It has not been collected in over half a century and hence is presumed extinct," (Stansbery, 1976: 43, 50).

Specimens Examined

Tennessee River System

Clinch River Drainage. *Tennessee*: Clinch River, Clinch River Station, Claiborne Co. (CM); Clinch River, Oakman, Grainger Co. (CM); Clinch River, Clinton, Anderson Co. (MCZ).

Holston River Drainage. *Tennessee*: Holston River, near Rogersville (MCZ);

Holston River, Austin Mill (CM), *both* Hawkins Co.; Holston River, 4 mi. above Morristown, Hamblen Co. (MZUM); Holston River, Holston Station; Holston River, Turley Mill, Noeton; *both* Grainger Co. (*both* CM). Holston River, Gant Island, nr. Straw Plains, Jefferson Co. (MZUM); mouth of Holston River, Austins Grist Mill; Holston River, Knoxville; *both* Knox Co. (*both* MCZ).

French Broad River Drainage. *Tennessee*: French Broad River, Boyd Creek, Sevier Co. (CM).

Tennessee River Drainage. *Tennessee*: Tennessee River, Knoxville, Knox Co. (MCZ). *Alabama*: Tennessee River, Bridgeport, Jackson Co. (MCZ); Tennessee River, Florence, Lauderdale Co. (MCZ); Tennessee River, Tuscumbia, Colbert Co. (MCZ); Pickwick Basin, mounds between Barton, Colbert Co. and Waterloo, Lauderdale Co. (Morrison, USNM).

Cumberland River System

Cumberland River Drainage. *Kentucky*: Cumberland River (MCZ); Big South Fork of Cumberland River, 2 mi. above Burnside, Pulaski Co. (Wilson and Clark). *Tennessee*: Cumberland River, Nashville, Davidson Co. (Say).

Plagiola (*Plagiola*) *lenior* (Lea)

Plate 11, figures 5–6

Distribution: Plate 7, figure C

Unio lenis Lea 1840, Proc. Amer. Philos. Soc. 1: 286 (Stones River, Tennessee), *non* Conrad 1840. Changed to:

Unio lenior Lea 1842, Trans. Amer. Philos. Soc. 8: 204, pl. 12, fig. 18, figured holotype USNM 86130; 1842, Obs. Unio 3: 42.

Truncilla lenior (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 518; 1914, Cat. Naiades 1: 11. Ortmann, 1918, Proc. Amer. Philos. Soc. 57: 587.

Dysnomia (*Truncillopsis*) *lenior* (Lea). Ortmann, 1924, Amer. Mid. Nat. 9: 34; 1925, Amer. Mid. Nat. 9: 360.

Dysnomia (*Penita*) *lenior* (Lea). Frierson, 1927, Check list N American naiades, p. 94. Haas, 1969, Das Tierreich, pt. 88, p. 484.

Dysnomia lenior (Lea). Stansbery 1970, Malacologia 10: 19, pl. 2, figs. 3, 4; 1971, Symposium of rare and endangered moll. U. S. p. 18f, figs. 3, 4.

Description. Shell usually of small size, reaching almost 40 mm in length. Outline of male subelliptical; of female subquadrate, a little narrower anteriorly. Valves inequilateral, subinflated to inflated, thin and delicate. Anterior end regularly rounded, posterior end of male slightly more broadly rounded; subtruncate in females. Ventral margin slightly curved. Dorsal margin almost straight, forming a slight angle with the obliquely descending posterior margin. Posterior ridge triple. Dorsal slope slightly rounded. Below the third ridge in females is a radially sculptured, toothed, raised marsupial swelling separated from the rest of the shell by two sulci, the more posterior one acute, ending in an emargination below the middle of the posterior slope. The marsupium projects slightly below the base and has a semicircular outline that extends posteriorly beyond it. Umbos slightly elevated, located toward the anterior third of the shell, their sculpture consisting of doubly-looped bars. Surface of the shell smooth with delicate growth lines. Periostracum subshiny, pale ashy-greenish, or yellowish green, with numerous, narrow green rays posteriorly.

Left valve with two delicate, subcompressed, pseudocardinal teeth; no interdentum. Two short, delicate, lateral teeth. Right valve with one pseudocardinal and one lateral tooth. Umbonal cavities very shallow. Anterior adductor muscle scars well impressed, posterior ones less so. Pallial line faint. The shell is thin, especially so in the marsupial furrow of the female. Nacre bluish white.

Length mm	Height mm	Width mm	
38	23	15	Eastern Tennessee. Male.
28	18	14	Stones River, Tennessee. Female. Identified by Lea.

Remarks. *Plagiola lenior* (Lea) is dis-

tinguished from other members of *Plagiola* by its thin shell and delicate green rays, which are restricted to the posterior end. The male might be mistaken for a young, pale colored *Villosa nebulosa* (Conrad), except that it has fine denticles on the posterior margin. The female has, in addition to the delicate shell, an acute sulcus behind the marsupial swelling that ends in an emargination below the middle of the posterior slope.

Range. Tennessee River system, Virginia, Tennessee and Alabama. Cumberland River system, restricted to Stones River, Tennessee.

Abundance. A rare species that appears to be somewhat locally abundant in the Paint Rock River, Alabama (Ortmann, 1918: 587). "The last known population of this species is now covered by the Priest Reservoir on the Stones River in Tennessee," (Stansbery, 1970: 19). It was last collected in the Stones River by Stansbery and Jenkinsen in 1965. Considered to be extinct in the Clinch River, above Norris Dam, Tazewell, Clairbone Co., Tennessee (Stansbery, 1972: 22). Listed as "extirpated" by Stansbery (1976: 43.50).

Specimens Examined

Tennessee River System

Powell River Drainage. *Virginia*: Powell River, Dickson Ford, 3 mi. SE Jonesville, Lee Co. (MZUM).

Clinch River Drainage. *Virginia*: Clinch River, Speers Ferry, (CM); Clinch River, Maness (MZUM); *both* Scott Co.

Holston River Drainage. *Tennessee*: North Fork, Holston River, Rotherwood, Hawkins Co. (CM); South Fork, Holston River, Pactolus, Sullivan Co. (CM); Holston River, Church Hill, Hawkins Co. (MCZ); Holston River nr. Knoxville, Knox Co. (Andrews, Walker colln. UZUM).

Paint Rock River Drainage. *Tennessee*: Paint Rock River, Holly Tree, Trenton, Paint Rock, *all* Jackson Co. (*all* CM); Paint Rock River, Woodville Jackson Co. (USNM, MZUM).

Duck River Drainage. *Tennessee*: Duck River, Columbia, Maury Co. (Hinkley and Marsh).

Cumberland River System

Stones River Drainage. *Tennessee*: Cumberland River ([written on shell] USNM) Stones River, 1.2 mi. W Couchville, Davidson Co. (MCZ).

Subgenus *Torulosa* Frierson

Torulosa Frierson 1927, Check list N American naiades, pp. 11, 94. Type species, *Amblema torulosa* Rafinesque, original designation, *teste* Errata et Corrigenda.

Capsaeformis Frierson 1927, Check list N American naiades, pp. 11, 95. Type species, *Unio capsaeformis* Lea, original designation, *teste* Errata et Corrigenda.

Description. Shell usually ovate, obovate or elliptical, occasionally triangular, male shell with a wide radiating depression, of varying depth, in front of the posterior ridge. The depression usually ends in an emargination. Female with a thin, compressed or subcompressed marsupial swelling that occupies the entire post-basal region.

Anatomy. In his discussion of the anatomy of *rangiana* (= *torulosa*), *florentina* and *capsaeformis*, Ortmann (1912a: 358–360) mentions no differences that would indicate any of these species should be placed in different subgenera.

Discussion. Frierson (1927) did not give descriptions of any of his new subgenera, but merely cited type species. He arbitrarily created subgenera for every assemblage of four or five species in genera of any size. Of the species recognized in this paper that would fall into *Capsaeformis*—namely *capsaeformis, florentina* and *turgidula*—all that can be said to differentiate them from other *Torulosa* is that they have thinner, smaller shells and that the radial depression in front of the posterior ridge in

capsaeformis and *florentina* is often faint. These minor conchological characters do not warrant the use of *Capsaeformis* as a subgenus.

Key to the Species of *Torulosa*

1. Shell elliptical, ovate, or obovate 2
   Shell subtriangular, subrhomboid, subquadrate or trapezoid 5
2. Shell thin, small, with a smooth surface 3
   Shell thick, often large, generally with some nodules ..... *torulosa*
3. Surface light yellow, honey colored, or yellowish green 4
   Surface green or greenish brown .. *capsaeformis*
4. Rays distributed evenly over the entire surface ..... *turgidula*
   Rays somewhat darker in the radial depression ..... *florentina*
5. Radial furrow oblique 6
   Radial furrow subvertical ..... *biemarginata*
6. Furrow wide and shallow, periostracum shiny ..... *sampsoni*
   Furrow narrow and deep, periostracum subshiny ..... *propinqua*

Plagiola (*Torulosa*) *torulosa* (Rafinesque)

Plate 11, figures 7–11
Plate 12, figures 1–5
Distribution: Plate 9, figure A

Amblema torulosa Rafinesque 1820, Ann. Gén. Sci. Physiques, Bruxelles 5: 314, pl. 82, figs. 11, 12 (l'Ohio et le Kentuky [Rivers]; holotype ANSP 20218 from the Kentucky River, refigured by Johnson and Baker, 1973, Proc. Acad. Nat. Sci. Phila. 125: 173, pl. 7, fig. 5).

Amblema torulosa angulata Rafinesque 1820, Ann. Gén. Sci. Physiques, Bruxelles 5: 315 (l'Ohio et le Kentuky [Rivers]; type [lost]).

Amblema gibbosa Rafinesque 1820, Ann. Gén. Sci. Physiques, Bruxelles 5: 315 (l'Ohio et les rivières adjacentes; lectotype ANSP 20232 from the Ohio River, selected by Johnson and Baker, 1973, Proc. Acad. Nat. Sci. Phila. 125: 156, pl. 7, fig. 6) [also the varieties: *olivacea*, *radiata* and *difformis*; all types lost].

Unio perplexus Lea, 1831, Trans. Amer. Philos. Soc. 4: 112, pl. 17, fig. 42 (Ohio River [Cincinnati, Hamilton Co., Ohio]), figured holotype USNM 84324; 1834, Obs. Unio 1: 122.

Unio gibbosus perobliquus Conrad 1836, Monography Unionidae, no. 6, p. 31, pl. 27, fig. 2 (Wabash River, Indiana; Detroit River, Michigan, type lost). The prominent knobs on the middle of the shell suggest the figured specimen came from the former locality and not from the Great Lakes drainage, where knobs are usually lacking. The type locality is here restricted to the Wabash River, Indiana.

Unio perobliquus Conrad, 1837, Monography Unionidae, no. 8 [back cover].

Unio rangianus Lea 1838, Trans. Amer. Philos. Soc. 6: 95, pl. 18, fig. 56 (Ohio River, near Cincinnati [Hamilton Co.]; Mahoning River, near Poland [Mahoning Co.]; *both* Ohio); type [lost]. Lectotype, here selected, USNM 84798 (pl. 12, Fig. 3), USNM 84798 from the latter locality; 1838, Obs. Unio 2: 95.

Unio cincinnatiensis Lea 1840, Proc. Amer. Philos. Soc. 1: 285 (Ohio River, Cincinnati [Hamilton Co.], Ohio); 1842, Trans. Amer. Philos. Soc. 8: 194, pl. 8, fig. 4, figured holotype USNM 84199; 1842, Obs. Unio. 3: 32.

Unio obliquus Potiez and Michaud 1844, Galérie Moll. Cat. Mus. Douai 2: 153, pl. 48, figs. 3, 4 (l'Ohio [River]); figured type in Mus Douai [not seen], *non* Lamarck 1820.

Unio phillipsii Reeve 1864, Conch. Iconica 16, *Unio*, pl. 4, species 15 (North America), figured holotype BMNH 196481, *non* Conrad 1835.

Unio gubernaculum Reeve, 1865, Conch. Iconica 16, *Unio*, pl. 28, species 146 (Hab.?), figured holotype BMNH 1965203.

Truncilla (*Scalenaria*) *sulcata delicata* Simpson 1900, Proc. U. S. Natl. Mus. 22: 520 (Detroit River, [Amherstburg, Essex Co., Ontario]; holotype USNM 160853 [only specimen]); 1914, Cat. Naiades 1: 16. Approaches *rangiana* (Lea), *teste*.

Dysnomia sulcata delicata Simpson Morrison, 1942, Bur. Amer. Ethnology Bull. no. 129, p. 364. La Rocque, 1967, Geol. Survey Ohio, Bull. no. 62 (2): 280.

Truncilla (*Pilea*) *perplexa* (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 522; 1914, Cat. Naiades 1: 24.

Dysnomia perplexa (Lea). Goodrich and van der Schalie, 1944, Amer. Mid. Nat. 32: 314.

Truncilla torulosa (Rafinesque). Ortmann, 1918, Proc. Amer. Philos. Soc. 57: 589. Ball, 1922, Ecology 3: 115.

Dysnomia (*Pilea*) *torulosa* (Rafinesque). Ortmann and Walker, 1922, Occ. Papers, Mus. Zool., Univ. Mich., no. 112, p. 69. Ortmann, 1925, Amer. Mid. Nat. 9: 363. La Rocque, 1967, Geol. Survey Ohio, Bull. 62 (2): 280, fig. 173.

Dysnomia torulosa (Rafinesque). Ortmann, 1926, Ann. Carnegie Mus. 17: 182. Morrison, 1942, Bur. Amer. Ethnology, Bull. 129, p. 364. Stansbery 1970, Malacologia 10: 20.

Dysnomia (*Torulosa*) *torulosa* (Rafinesque). Frierson, 1927, Check list N American naiades, p. 94. Haas, 1969, Das Tierreich, pt. 88, p. 485.

Truncilla (*Pilea*) *perplexa rangiana* (Lea). Simp-

son, 1900, Proc. U. S. Natl. Mus. 22: 523. Ortmann, 1909, Ann. Carnegie Mus. 5: 188. Simpson, 1914, Cat. Naiades 1: 25.

Truncilla rangiana (Lea). Ortmann, 1912, Ann. Carnegie Mus. 8: 358, fig. 28 (anatomy); 1919, Mem. Carnegie Mus. 9: 331, pl. 21, figs. 5–7. Ball, 1922, Ecology 3: 117. Danglade, 1922, U. S. Bur. Fisheries. Doc. no. 934: 5.

Dysnomia (*Torulosa*) *rangiana* (Lea). Frierson, 1927, Check list N American naiades, p. 95.

Dysnomia perplexa rangiana (Lea). Goodrich, 1932, Moll. Mich. p. 113. van der Schalie, 1941, Jour. Conch. 21: 251.

Dysnomia (*Pilea*) *torulosa rangiana* (Lea). La Rocque, 1967, Geol. Survey Ohio, Bull. 62 (2): 283.

Dysnomia (*Torulosa*) *torulosa rangiana* (Lea). Haas, 1969, Das Tierreich, pt. 88, p. 486.

Truncilla (*Pilea*) *perplexa cincinnatiensis* (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 523; 1914, Cat. Naiades 1: 26.

Dysnomia (*Torulosa*) *torulosa cincinnatiensis* (Lea). Frierson, 1927, Check list N American naiades, p. 94. Haas, 1969, Das Tierreich, pt. 88, p. 486.

Dysnomia torulosa cincinnatiensis (Lea). Morrison, 1942, Bur. Amer. Ethnology, Bull. no. 129: 365.

Dysnomia (*Pilea*) *torulosa cincinnatiensis* (Lea). La Rocque, 1967, Geol. Survey Ohio, Bull. 62 (2): 283.

Truncilla torulosa gubernaculum (Reeve). Ortmann, 1918, Proc. Amer. Philos. Soc. 57: 590. Ball, 1922, Ecology 3: 114.

Dysnomia torulosa gubernaculum (Reeve). Ortmann, 1926, Ann. Carnegie Mus. 17: 182. Stansbery, 1971. Symposium of rare and endangered moll. U. S., p. 18f, figs. 49, 50.

Dysnomia (*Torulosa*) *torulosa gubernaculum* (Reeve). Frierson, 1927, Check list N American naiades, p. 95.

Epioblasma torulosa gubernaculum (Reeve). Stansbery, 1972, Amer. Mal. Union, Bull. for 1972, p. 22.

Description. Shell of medium size, reaching almost 90 mm in length. Outline irregularly ovate, elliptical or obovate. Valves inequilateral, subinflated to inflated, solid. Anterior end regularly rounded, posterior end of male slightly produced; more broadly rounded in females. Ventral margin slightly curved. Dorsal margin curved forming an indistinct angle with the obliquely descending posterior margin. Hinge ligament short. Posterior ridge of the male rather low, narrowly rounded, separated from a similar medial ridge by a broad furrow of varying depth that ends in an emargination between the somewhat produced ridges. Both the ridges and the furrow vary from being smooth to having elevated knobs. The marsupial swelling in the female is sometimes marked by a number of small radial furrows, but the ridges become obscure. The rounded marsupial swelling extends from the middle of the base to the upper part of the posterior end. Umbos full, somewhat turned over a small lunule, located toward the anterior third of the shell, their sculpture feeble and corrugated. Surface of the shell with many distinct growth lines. Periostracum smooth and shiny, tawny, yellowish green, or straw colored, usually with numerous green rays.

Left valve with two triangular pseudocardinal teeth; slight interdentum. Two long, almost straight, lateral teeth. Right valve with one large pseudocardinal tooth with a smaller tooth before it. One lateral tooth, sometimes with a vestigial tooth below. Umbonal cavity shallow. Anterior and posterior adductor muscle scars and pallial line, well impressed. The shell is thin in the marsupial region of the female especially toward the margin. Nacre white to salmon-red.

Male shells are generally irregularly ovate with a rather wide radial furrow of varying depth ending in a broad sinus, often bluntly pointed behind.

Female shells are generally obovate, larger than the male, having a large, flattened, rounded marsupial swelling extending from the middle of the base to near the upper part of the posterior end, which is thin and often a darker green than the rest of the shell.

Length mm	Height mm	Width mm	
68	57	42	Wabash River, Indiana. Male.
85	59	38	As above. Female.

Habitat. Lives in coarse sand and gravel, in current, and in water from a few inches to 4 to 6 feet (Parmalee:1967: 62).

Remarks. Plagiola torulosa (Rafinesque) exhibits considerable ecophenotypic variation as to sculpture, or the lack of it, and to obesity. Ball (1922: 116) convincingly showed the relationship in this species between strong tubercle development and large stream-flow and between the lack of tubercles and small stream flow, as well as *torulosa*'s tendency to be more compressed in smaller streams. Ortmann (1918: 590) had previously noted that in the Tennessee River, "the typical *torulosa* has a radial row of prominent knobs across the middle of the shell. But these knobs vary greatly, and in the upstream direction, they have a tendency to become reduced, finally disappearing, thus passing into the condition seen in the next form [*gubernaculum* Reeve]. From the typical *torulosa*, this variety differs by the poorly developed, or wanting, knobs, and by the rather more compressed shell. This is the headwaters form of *torulosa* and begins to take place in the [Tennessee River] in the vicinity of Knoxville [Knox Co., Tennessee]." Ortmann further observed the variance of tubercules and obesity in relationship to stream size in the Ohio River system (1918: 590) and in the Green River (1926: 182).

Though Ortmann recognized clinal variation in *torulosa*, and Ball carefully documented it, some taxa (applied to ecophenotypic varients of *torulosa*) continue to be promulgated in the literature as if they referred to subspecies. *E. torulosa*, like many other unionid species when found in large lakes, show some ecophenotypic variation. Often these forms have been named; in this case, *Dysnomia sulcata delicata* Simpson.

Ortmann (1926: 182) mentioned that Walker had specimens of *torulosa* from the Cumberland River. "According to the labels, they have gone through the hands of Wetherby and Marsh, and probably were collected by Dr. Lindsey in 1877." Additional specimens from this lot in the Museum of Zoology, University of Michigan are now in the Museum of Comparative Zoology 236769. Since this species appears to have been relatively abundant where located, and as it was not found during the extensive Cumberland River collecting reported by Wilson and Clark (1914), this record is regarded as spurious.

Range. Tennessee River system, Tennessee and Alabama; Ohio River system: from Illinois to Pennsylvania, including the Wabash, Green, Licking and Kentucky River drainages; St. Lawrence River system: Lakes Michigan, Huron, and Erie.

Abundance. Still occasionally collected in commercial operations on the lower Ohio River (Kentucky-Illinois) (Parmalee 1967: 62) and from the Nolichucky River near its mouth in western Tennessee. Persists in smaller streams in the Ohio and lower Great Lakes systems [Stansbery as *D. t. rangiana*] and in the Clinch River, Tennessee [Stansbery as *D. t. gubernaculum*]. Gone throughout the rest of its previous range (Stansbery, 1970; 20). *Epioblasma torulosa torulosa* is listed as "extirpated" by Stansbery (1976: 43, 51).

Specimens Examined

Tennessee River System

Powell River Drainage. *Virginia*: Powell River, Jonesville, Lee Co. (MCZ); Powell River, Shawanee, Clairborne Co. (CM).

Clinch River Drainage. *Virginia*: Clinch River, Dungannon (CM); Clinch River, Hill Station, 5.5 mi. below Fort Blackmore (MCZ); Clinch River, Clinchport (MCZ); *all* Scott Co. *Tennessee*: Clinch River, Kyles Ford, Hancock Co. (MZUM); Clinch River, Union Co.; Clinch River, Clinton, Anderson Co. (*both* MCZ).

Holston River Drainage. *Virginia*: North Fork, Holston Bridge, Scott Co. (CM). *Tennessee*: Holston River, McBee Ford, Hodges, Jefferson Co.; mouth of Holston River, Austins Grist Mill, Knox Co. (*both* MCZ).

French Broad River Drainage. *Tennessee*: Nolichucky River, 3.5 mi. SE Warrensburg, Greene Co. (MCZ); Nolichucky River, Chunns Shoals, Hamblen Co. (CM).

Tennessee River Drainage. *Tennessee*: Tennessee River near Knoxville, Knox Co. (MCZ); Tennessee River, Chattanooga, Hamilton Co. (CM).

Paint Rock River Drainage. *Alabama*: Paint Rock River, Poplar Bluff Ridge, Madison Co. (MCZ).

Tennessee River Drainage. *Alabama*: Tennessee River, 6 mi. E Decatur Morgan Co. (MZUM).

Elk River Drainage. *Alabama*: Elk River, Fayetteville, Lincoln Co. (MZUM).

Tennessee River Drainage. *Alabama*: Tennessee River, Muscle Shoals, Colbert and Lauderdale Cos. (MCZ, CM); Tennessee River, Florence, Lauderdale Co. (MCZ, USNM); Tennessee River, Tuscumbia, Colbert Co. (USNM); Pickwick Basin, mounds between Barton, Colbert Co. and Waterloo, Lauderdale Co. (Morrison, USNM).

Ohio River System

Ohio River Drainage. *Illinois*: Ohio River, Metropolis, Massac Co. (Parmalee, 1967).

Wabash River Drainage. *Indiana*: Eel River, N Manchester, Montgomery Co. (MCZ); Blue River, Morristown (MZUM); Conn Creek, Waldron; East Fork Flat Rock Creek, [town of] Flat Rock Creek (*both* MCZ); *all* Shelby Co. [Mississinewa River], Albany, Delaware Co. (USNM); White River, Indianapolis, Marion Co. (MZUM); White River, Rockford, Jackson Co. (CM). Wabash River, Delphi; Wild Cat Creek; *both* Carroll Co. (*both* MCZ). Wabash River, Lafayette, Tippecanoe Co. (MCZ). Wabash River, New Harmony, Posey Co. (USNM).

Green River Drainage. *Kentucky*: Green River, 8 mi. S Campbellsville, Taylor Co. (MCZ); Green River, Greensburg, Green Co. (MZUM); Mamouth Cave, Edmondson Co. (MCZ); Drakes Creek, 1 mi. SE Mt. Victor (MZUM); Barren River, Bowling Green (MCZ); *both* Warren Co.

Kentucky River Drainage. *Kentucky*: Kentucky River (Rafinesque and Danglade).

Licking River Drainage. *Kentucky*: Licking River (MCZ).

Ohio River Drainage. *Ohio*: Ohio River, Cincinnati, Hamilton Co. (MCZ).

Little Miami River Drainage. *Ohio*: Little Miami River (MCZ).

Scioto River Drainage. *Ohio*: Scioto River, Columbus, Franklin Co.; Big Darby Creek, 4 mi. S Orient (*both* MCZ); Scioto River, Circleville (USNM); *both* Pickaway Co.; Scioto River, Chillicothe, Ross Co. (USNM).

Muskingum River Drainage. *Ohio*: Tuscarawas River, New Philadelphia, Tuscarwas Co. (MCZ).

Ohio River Drainage. *Ohio*: Ohio River, Marietta, Washington Co. (MZUM).

Big Beaver River Drainage. *Ohio*: [Little Mahoning River], Newton Falls, Trumbull Co. (MZUM); Mahoning River, near Garrettsville, Portage Co. (MCZ); Mahoning River, near Poland, Mahoning Co. (Lea). *Pennsylvania*: Shenango River, Pulaski and Harbor Bridge; *both* Lawrence Co. (*both* CM).

Allegheny River Drainage. *Pennsylvania*: Allegheny River, Warren, Warren Co. (MCZ); Allegheny River, Hickory and Tionesta, *both* Forest Co.; Allegheny River, Walnut Bend, Venango Co.; French Creek, Meadville and Cochranton, *both* Crawford Co.; French Creek, Utica, Venango Co.; Allegheny River, Templeton, Johnetta, Godfrey, and Aladdin; *all* Armstrong Co. (*all* CM).

Monongahela River Drainage. *West Virginia*: West Fork Lynch Mines, Harrison Co. (CM).

St. Lawrence River System

Great Lakes Drainage. (Lake Michigan) *Michigan*: Grand River, Grand Rapids, Kent Co. (MCZ). (Lake Huron) *Michigan*: Black River, 1.5 mi. W Amadore, Salinac Co. (MZUM). (Lake Erie)

Michigan: Clinton River, Pontiac, Oakland Co. (MZUM). *Ontario*: Syndenham River, 1.8 mi. NE Shetland, Lambton Co. (Clarke); Detroit River [=Lake Erie], Amherstburg (USNM); Detroit River, Bois Blanc Isle (MZUM); *both* Essex Co. *Michigan*: Huron River, Huron Park, Wayne Co.; River Raisin, Petersburg, Monroe Co. (*both* MZUM). *Indiana*: St. Marys River (MZUM).

Plagiola (*Torulosa*) *sampsoni* (Lea)

Plate 12, figures 6, 7
Distribution: Plate 6, figure B

Unio sampsonii Lea 1861, Proc. Acad. Nat. Sci. Phila. 13: 392 (Wabash River, New Harmony [Posey Co.], Indiana); 1862, Jour. Acad. Nat. Sci. Phila. (2)5: 192, pl. 25, fig. 261, figured holotype UNSM 84802; 1863, Obs. Unio 9: 14.

Truncilla (*Pilea*) *sampsoni* (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 523; 1914, Cat. Naiades 1: 27.

Truncilla sampsoni (Lea). Ball, 1922, Ecology 3: 117.

Dysnomia (*Torulosa*) *sampsoni* (Lea). Frierson, 1927, Check list N American naiades, p. 95. Haas, 1969, Das Tierreich, pt. 88, p. 486.

Dysnomia sampsoni (Lea). Goodrich and van der Schalie, 1944, Amer. Mid. Nat. 32: 314. Parmalee, 1967, Illinois State Mus., Popular Sci. Ser. 8: 92, pl. 30 E. Stansbery, 1970, Malacologia 10: 20, pl. 2, fig. 6; 1971, Symposium of rare and endangered moll. U. S., p. 18b, fig. 18.

Description. Shell of medium size, seldom reaching over 50 mm in length. Outline subquadrate or trapezoid. Valves inequilateral, inflated, solid. Anterior end regularly rounded, posterior end of the male somewhat pointed, rather broadly rounded in females. Ventral margin straight or slightly curved. Dorsal margin usually sufficiently straight to form an angle with the obliquely descending posterior slope, but sometimes rounded and joining the posterior margin imperceptibly. Hinge ligament short. Posterior ridge low, narrowly rounded, separated from a somewhat broader medial ridge by a distinct furrow that ends in an emargination between the somewhat produced ridges in most males, though in some males the furrow ends in a straight line; in females it is broadly rounded. The ridges are occasionally slightly knobbed, but the furrow is always smooth. The marsupial swelling in the female is infrequently marked by a number of small radial furrows. The rounded marsupial swelling extends from the middle of the base to the upper part of the posterior end. Umbos high and full, turned over a small wide lunule, located toward the anterior third of the shell, their sculpture feeble and corrugated. Surface of the shell rather smooth, usually with a concentric constriction at the rest marks. Periostracum smooth, usually shiny, though sometimes sulky, yellowish green or straw colored with numerous green rays.

Left valve with two triangular pseudocardinal teeth; slight interdentum. Two moderately long, almost straight, lateral teeth. Right valve with one large pseudocardinal tooth with a smaller tooth before and after it. One lateral tooth, sometimes with a vestigial tooth below. Umbonal cavity shallow. Anterior and posterior muscle scars and pallial line well impressed. Nacre bluish white to salmon.

Usually female shells do not differ greatly in outline from the male. The female marsupial swelling is usually just a little produced, not differing in color or texture from the rest of the shell.

Length mm	Height mm	Width mm	
45	42	28	Lower Wabash River, Indiana. Male. (USNM).
52	50	34	As above. Female.

Habitat. Lives in sand and gravel bars, never in mud. (Lea).

Remarks. Plagiola sampsoni (Lea) most closely resembles *P. torulosa* (Rafinesque), but it differs from the latter in that it does not reach such large size, it is almost always devoid of knobs, and both the male and female shells are subquadrate or trapezoid in outline (a characteristic that does not vary

much because of sexual differences). The outline of the male *torulosa* is ovate and that of the female obovate; the marsupial swelling of the female is darker than the rest of the shell, whereas in *sampsoni* it is the same color as the rest of the shell. *P. sampsoni* also resembles *P. propinqua* in that it is generally without knobs. However, male shells of the latter are subtriangular in outline while those of the female are subelliptical. The periostracum of *sampsoni* is generally shiny while that of *propinqua* is almost always subshiny.

Call (1900: 476) included *sampsoni* under the synonymy of *Unio perplexus* [= *torulosa*]. Goodrich and van der Schalie (1944: 314) suggested that *sampsoni* might be a large river form or variant of *Dysnomia perplexa*, though they admitted there were characters that might entitle it to specific rank. Stansbery (1970: 20, pl. 2, fig. 6) thought *sampsoni* might be simply a variant of the subspecies he recognized as *Dysnomia torulosa rangiana* (Lea). As pointed out above, both the male and female shell of *sampsoni* have sufficient characters to separate it from the other *Plagiola*.

Range. Tennessee River system, Tennessee. Ohio River system: lower Wabash River drainage, Indiana; Ohio River drainage to Cincinnati, Hamilton Co., Ohio.

Abundance. This species was not mentioned by Ortmann (1918, 1925) or Morrison (1942) in their studies of the unionids of the Tennessee River system. Ball (1922: 117) had only three specimens without locality data, which could not be presently located in the Carnegie Museum. It is presumed to be known from the Tennessee River system, from a male and female specimen in the Museum of Comparative Zoology merely labeled, "Tennessee."

Formerly found in fair numbers in the lower Wabash River, Indiana. Not located there by Meyer (1974) or Clark (1976). Considered extinct by Stansbery (1970: 20).

Specimens Examined

Tennessee River System

Tennessee River Drainage. *Tennessee*: Tennessee (MCZ. Locality as well as the collector, Steward, written on the male and female shells).

Ohio River System

Wabash River Drainage. *Indiana*: White River (MZUM). Wabash River, New Harmony (MZUM, USNM, ANSP); Grand Chain (USNM); *both* Posey Co. *Illinois*. Wabash River, 'Little Chains,' [archaeological site], 10 mi. above confluence with the Ohio River, White Co. (Parmalee).

Ohio River Drainage. *Ohio*: Ohio River (ANSP); Ohio River, Cincinnati, Hamilton Co. (MCZ).

Plagiola (*Torulosa*) *propinqua* (Lea)

Plate 12, figures 8, 9

Distribution: Plate 6, figure B

Unio propinquus Lea, 1857, Proc. Acad. Nat. Sci. Phila. 9: 83 ([Tennessee River], Florence [Lauderdale Co.]; [Tennessee River] Tuscumbia [Colbert Co.]; *both* Alabama); 1861, Jour. Acad. Nat. Sci. Phila. (2) 5: 63, pl. 5, fig. 212, figured holotype USNM 84332 from the former locality; 1862, Obs. Unio 8: 67.

Truncilla (*Pilea*) *propinqua* (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 523; 1914, Cat. Naiades 1: 27.

Truncilla propinqua (Lea). Ortmann, 1918, Proc. Amer. Philos. Soc. 57: 589. Ball, 1922, Ecology 3: 113.

Dysnomia (*Pilea*) *torulosa propinqua* (Lea). Ortmann, 1925, Amer. Mid. Nat. 9: 363.

Dysnomia (*Torulosa*) *propinqua* (Lea). Frierson, 1927, Check list N American naiades, p. 95. Haas, 1969, Das Tierreich, pt. 88, p. 487.

Dysnomia propinqua (Lea). Morrison, 1942, Bur. Amer. Ethnology, Bull. no. 129, p. 365. Stansbery, 1970, Malacologia 10: 20, pl. 2, fig. 5; 1971, Symposium of rare and endangered moll. U. S., p. 18b, fig. 17.

Description. Shell of medium size, seldom reaching over 60 mm in length. Outline subtriangular, subelliptical or subquadrate. Valves very inequilateral, inflated,

solid. Anterior end regularly rounded, posterior end of male more broadly rounded, sometimes somewhat pointed; posterior more broadly and evenly rounded in females. Ventral margin curved. Dorsal margin sometimes sufficiently straight to form an angle with the obliquely descending posterior margin, but often rounded and joining the posterior margin imperceptibly. Hinge ligament short. Posterior ridge low, narrowly rounded, median ridge full or rounded, sometimes the ridges are slightly knobbed. Dorsal slope usually rounded. The radial furrow that separates the ridges varies in both depth and width, but it is usually rather deep, especially in the male. Umbos full and high, somewhat turned over a small wide lunule, located in the anterior quarter of the shell, their sculpture is feebly corrugated. Surface of the shell with many distinct growth rests. Periostracum varying from straw-colored or tawny to yellow green with feeble green rays, subshiny or somewhat silky.

Left valve with two chunky triangular pseudocardinal teeth; slight interdentum. Two short, slightly curved lateral teeth. Right valve with one large triangular pseudocardinal tooth usually with a smaller tooth before and behind it. One lateral tooth, sometimes with a vestigial tooth below. Umbonal cavities shallow. Anterior and posterior adductor muscle scars, and pallial line, well impressed. Nacre bluish white, rarely pinkish.

Male shells subtriangular, with the radial furrow usually deep, ending in a narrow sinus below.

Female shells subelliptical or subquadrate, the marsupial swelling rounded and moderately produced, the radial furrow becoming obscure posteriorly. Marsupial swelling sometimes darker than the rest of the shell.

Remarks. *Plagiola propinqua* (Lea) bears some resemblance to *P. torulosa*, and though the former may be slightly knobbed, it is generally smooth. The male of *propinqua* is subtriangular in outline, while that of *torulosa* is generally irregularly [illegible] the posterior ridge of the former [illegible] more obliquely angled, and the radial furrow is narrower and deeper than in *torulosa*. The female of *propinqua* is subelliptical in outline, while the *torulosa* female is produced posteriorly and obovate. The radial furrow of *propinqua* is narrow and deep except in the post-basal region where there is some marsupial swelling. The posterior end of the female *torulosa* is without a radial furrow, but is instead a large flattened marsupial swelling that extends from the middle of the ventral margin to the upper part of the posterior margin. While the marsupial area of *propinqua* is usually the same color as the rest of the shell, that of *torulosa* is often a darker green.

Simpson (1914: 24) correctly recognized *propinqua* as a distinct species, but Ortmann (1925: 363) in interpreting the data of Ball (1922: 115) regarded *propinqua* as merely a *torulosa* with the tubercules very poorly developed or absent. Morrison (1942: 365) examined thousands of *torulosa* and *propinqua* specimens from Indian mounds of the Pickwick Landing Basin, Colbert and Lauderdale counties, Alabama and found no integrades between them.

Range. Tennessee River system, Tennessee and Alabama; Cumberland River system, Tennessee; Ohio River system: from the lower Wabash River drainage, Indiana to the Ohio River, Cincinnati, Hamilton County, Ohio.

Abundance. This species was not found by Wilson and Clark (1914) in the Cumberland River system. Considered extinct by Stansbery (1976: 43, 51).

Specimens Examined

Tennessee River System

Clinch River Drainage. *Tennessee*: Clinch River, Clinton and Edgemoor, *both* Anderson Co. (*both* CM).

Holston River Drainage. *Tennessee*: mouth of Holston River, Austins Grist Mill, Knox Co. (MCZ; MZUM).

Tennessee River Drainage. *Tennessee*: Tennessee River, Knoxville, Knox Co. (MCZ); *Alabama*: Tennessee River, Muscle Shoals, Colbert and Lauderdale Cos. (CM); Tennessee River, Florence, Lauderdale Co. (MCZ, MZUM); Tennessee River, Tuscumbia, Colbert Co. (MCZ); Pickwick Basin, mounds between Barton, Colbert Co. and Waterloo, Lauderdale Co. (Morrison, USNM).

Cumberland River System

Cumberland River Drainage. *Tennessee*: Cumberland River (Simpson, 1914: 27; MZUM; MCZ). [Cumberland River], Nashville, [Davidson Co.] (MCZ, data written on the shells).

Ohio River System

Wabash River Drainage. *Indiana*: White River (MZUM); Wabash River, New Harmony, Posey Co. (MCZ; MZUM).

Ohio River Drainage. *Ohio*: Ohio River, Cincinnati, Hamilton Co. (MCZ).

Plagiola (*Torulosa*) *biemarginata* (Lea)

Plate 13, figures 1, 2

Distribution: Plate 9, figure A

Unio biemarginatus Lea 1857, Proc. Acad. Nat. Sci. Phila. 9: 83 ([Tennessee River], Florence [Lauderdale Co.], Alabama); 1866, Jour. Acad. Nat. Sci. Phila. (2) 6: 47, pl. 16, fig. 45, figured holotype USNM 84608; 1867, Obs. Unio 11: 51.

Truncilla (*Pilea*) *biemarginata* (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 524; 1914, Cat. Naiades 1: 28.

Dysnomia (*Pilea*) *biemarginata* (Lea). Ortmann, 1925, Amer. Midland Nat. 9: 361.

Dysnomia (*Torulosa*) *biemarginatus* (Lea). Frierson, 1927, Check list N American naiades, p. 95. Haas, 1969, Das Tierreich, pt. 88, p. 487.

Dysnomia biemarginata (Lea). Morrison, 1942, Bur. Amer. Ethnology, Bull. no. 129: 364. Stansbery, 1970, Malacologia 10: 20; 1971, Symposium of rare and endangered moll. U. S., p. 18b, figs. 13, 14.

Description. Shell usually small, seldom reaching more than 50 mm in length. Outline subtriangular, subrhomboid, or irregularly obovate. Valves not much inflated, solid, inequilateral. Anterior end regularly rounded, posterior end of male less broadly rounded, subtruncated; more broadly and more evenly rounded in females. Ventral margin of male curved, of female almost straight before the marsupial swelling. Dorsal margin of male long, forming a sharp angle with the obliquely descending posterior margin; of female short forming a less sharp angle with the obliquely descending posterior margin. Hinge ligament rather long. Posterior ridge of male with a sharp, biangulate, posterior ridge ending in a biangulation below, median ridge full and rounded, the radial depression between the ridges wide and shallow. Dorsal slope concave. Posterior ridge of the female faintly biangulate, the radial depression between it and the medial ridge shallow and fading out on the marsupial swelling. Umbos moderately full and inflated, located slightly anterior of the middle, their sculpture not observed. Surface of the shell with strong and irregular growth rests. Periostracum yellowish green, with numerous green rays of varying width over the entire surface.

Left valve with two chunky triangular pseudocardinal teeth; slight interdentum. Two long, almost straight, lateral teeth. Right valve with one large triangular pseudocardinal tooth, usually with a much smaller tooth before and behind it. One lateral tooth. Umbonal cavities shallow. Anterior and posterior adductor muscle scars and pallial line well impressed. Shell thinner posteriorly in both sexes. Nacre bluish white to creamy.

Male shells are subtriangular, or subrhomboid, with a sharply biangulate posterior ridge that ends posteriorly in a biangulation. There is a wide shallow radial depression before a full rounded medial ridge.

Female shells are obovate, having a large flattened, rounded marsupial swelling extending from the middle of the base to the upper part of the posterior end. The radial

depression between the faintly biangulate posterior ridge and the medial ridge is shallow and fades out on the marsupial swelling which is darker than the rest of the shell.

Length mm	Height mm	Width mm	
50	38	27	Tennessee River, Muscle Shoals, Colbert and Lauderdale Cos., Alabama. Male.
38	28	17	As above. Female.

Remarks. *Plagiola biemarginata* (Lea) bears a resemblance to both *P. perplexa* and *propinqua.* It is smaller than both of them, and is not knobbed as *perplexa* often is. It may be distinguished easily from *propinqua*, which has a much higher shell in relation to length. While close to the same proportions as *perplexa*, *biemarginata* is easily separated from it by the decidedly more acutely biangulate posterior ridge, which ends in a sharper biangulation at the posterior end in males, and has a concave dorsal slope. The wide green rays on both sexes of *biemarginata* distinguish it from *perplexa* and *propinqua.*

Range. Tennessee River system, Tennessee and Alabama; Cumberland River system, Big South Fork, Kentucky.

Abundance. Considered extinct by Stansbery (1970: 20; 1976: 43, 50).

Specimens Examined

Tennessee River System

Clinch River Drainage. *Tennessee*: Clinch River, "The Rounds," Hancock Co. (MCZ).

Holston River Drainage. *Tennessee*: Holston River, Knox Co. (MCZ).

Sequatchie River Drainage. *Tennessee*: Sequatchie River (MZUM).

Paint Rock River Drainage. *Alabama*: Paint Rock River, Paint Rock, Jackson Co. (MZUM).

Flint River Drainage. *Alabama*: Flint River (MZUM).

Elk River Drainage. *Tennessee*: Elk River, Fayetteville, Lincoln Co. (MZUM).

Tennessee River Drainage. *Alabama*: Tennessee River, Muscle Shoals, Colbert and Lauderdale Cos.; Tennessee River, Florence, Lauderdale Co.; Tennessee River, Tuscumbia, Colbert Co.; (*all* MCZ); Pickwick Basin, mounds between Barton, Colbert Co. and Waterloo, Lauderdale Co. (Morrison, USNM).

Cumberland River System

Cumberland River Drainage. *Kentucky*: Big South Fork, Burnside, Pulaski Co. (MZUM).

Plagiola (*Torulosa*) *capsaeformis* (Lea)

Plate 13, figures 3, 4
Distribution: Plate 7, figure B

Unio capsaeformis Lea 1834, Trans. Amer. Philos. Soc. 6: 31, pl. 2, fig. 4 (Cumberland River [Tennessee], figured holotype MCZ 178570); 1834, Obs. Unio 1: 143.

Truncilla (*Pilea*) *capsaeformis* (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 524; 1914, Cat. Naiades 1: 29.

Truncilla capsaeformis (Lea). Ortmann, 1912, Ann. Carnegie Mus. 8: 359 [anatomy mistakenly described under *florentina*]; 1913, Proc. Amer. Philos. Soc. 52: 311. Goodrich, 1913, Nautilus 27: 95.

Dysnomia (*Pilea*) *capsaeformis* (Lea). Ortmann, 1924, Amer. Mid. Nat. 9: 38; 1925, Amer. Mid. Nat. 9: 362.

Dysnomia (*Capsaeformis*) *capsaeformis* (Lea). Frierson, 1927, Check list N American naiades, p. 95. Haas, 1969, Das Tierreich, pt. 88, p. 487.

Dysnomia capsaeformis (Lea). Wilson and Clark, 1914, U. S. Bur. Fisheries, Doc. 781, p. 46. Morrison, 1942, Bur. Amer. Ethnology, Bull. no. 129, p. 364. Neel and Allen, 1964, Malacologia 1: 448. Van der Schalie, 1973, Sterkiana, no. 52, pp. 46, 48, 50, 51.

Epioblasma capsaeformis (Lea). Stansbery, 1972, Amer. Mal. Union, Bull. for 1972, p. 22.

Description. Shell of medium size, reaching about 70 mm in length. Outline elliptical or irregularly obovate. Valves somewhat inequilateral, subinflated, subsolid. Anterior end regularly rounded, posterior end of male slightly produced; more broad-

ly rounded in females. Ventral margin slightly, but uniformly, curved in the male; almost straight in females to the sulcus, behind which the marsupial swelling extends well below the base. Dorsal margin straight, forming an angle with the obliquely descending posterior margin. Hinge ligament short. Posterior ridge of the male, double, but faint, ending in a slight biangulation posteriorly; ridge scarcely visible in females. There is sometimes a faint radial depression in front of the lower posterior ridge of the male. The considerable marsupial swelling of the female is usually marked by a sulcus before and behind and is sometimes finely toothed on the margin. Umbos quite full and elevated, located slightly anterior of the middle in the male, and in the anterior third of the shell in the female; umbonal sculpture not observed. Surface of the shell with uneven growth lines. Periostracum subshiny, yellowish green with numerous fine green rays over the entire surface, marsupial area of the female usually dark green, sometimes blackish.

Left valve with two, chunky, triangular pseudocardinal teeth; slight interdentum. Two short, slightly curved lateral teeth. Right valve with one large triangular pseudocardinal tooth, usually with a smaller tooth before it that is parallel to the hinge line. One lateral tooth, sometimes with a vestigial tooth below. Umbonal cavities shallow. Anterior adductor muscle scars well impressed, posterior ones shallow. Pallial line distinct anteriorly. Nacre bluish white. Shell heavier anteriorly, posterior end of females especially thin and iridescent.

Male shells irregularly elliptical, with a double, but faint, posterior ridge, which ends in a slight biangulation, near the median.

Female shells irregularly obovate with a thin, slightly inflated, marsupial swelling, which may be considerably produced and extended well below the base, often marked by two distinct sulci, sometimes toothed on the margin.

Length mm	Height mm	Width mm	
60	40	24	Duck River, Milltown, Marshall Co., Tennessee. Male.
60	43	21	As above. Female.

Remarks. *Plagiola capsaeformis* (Lea) bears some resemblance both to *P. perplexa* and *florentina.* Only the female resembles *perplexa*, but that of *capsaeformis* is always smaller, thinner and without knobs. Both the male and female of *capsaeformis* resemble *florentina*, but the male of the former is longer, lower and less swollen than that of *florentina.* In the *capsaeformis* female the marsupial swelling is darker than the rest of the shell, while in *florentina* the periostracum (in both sexes) is a uniform honey yellow or yellowish brown. The green rays of the latter are more evenly distributed.

Range. Tennessee River system, Virginia, Tennessee and Alabama; Cumberland River system, Kentucky and Tennessee.

Abundance. The number of specimens seen in collections indicates this species must have been abundant, especially in the Tennessee River system.

Specimens Examined

Tennessee River System

Powell River Drainage. *Virginia*: Powell River, 2.5 mi. S Jonesville, Lee Co. *Tennessee*: Powell River, Shawnee (CM); Powell River, 8–10 mi. N Tazewell (MCZ); *both* Claiborne Co.; Powell River, Greens Ford, 2 mi. NW Long Hollow, Union Co. (MCZ).

Clinch River Drainage. *Virginia*: Clinch River, Cedar Bluff, Tazewell Co. (CM); Clinch River, Cleveland, Russell Co. (MCZ); Clinch River, Dungannon, Clinchport, and below Speers Ferry Bridge, *all* Scott Co. (*all* MCZ); Clinch River, 1.5 mi.

S Dona, Lee Co. (MCZ). *Tennessee*: Clinch River, Kyles Ford, and "The Rounds," *both* Hancock Co. Clinch River, 4 mi. NW Thorn Hill, Grainger Co.; Clinch River, Clinton, Anderson Co. (*all* MCZ).

Holston River Drainage. *Virginia*: North Fork, Mendota, Washington Co. (CM); North Fork, Hilton, Scott Co. (MCZ). *Tennessee*. North Fork, Clouds Ford, 2 mi. W Morrison (MCZ); South Fork, Pactolus (CM); *both* Sullivan Co.; mouth of Holston River, Austins Grist Mill, Knox Co. (MCZ).

French Broad River Drainage. *North Carolina*: French Broad River, Asheville, Buncombe Co. (MZUM). *Tennessee*: Nolichucky River, 3.5 mi. SE Warrensburg, Green Co.

Tennessee River Drainage. *Tennessee*: Tennessee River, near Knoxville, Knox Co. (*both* MCZ); Little Tennessee River, Coytee, Loundon Co. (MZUM).

Paint Rock River Drainage. *Alabama*: Paint Rock River, Princeton, Holly Tree, and Trenton (*all* MCZ); between New Hope and Paint Rock (CM); *all* Jackson Co.

Flint River Drainage. *Alabama*: Flint River, Gurley, Madison Co. (MCZ).

Limestone Creek Drainage. *Alabama*: Limestone Creek, Mooresville, Limestone Co. (MZUM).

Elk River Drainage. *Tennessee*: Elk River, Winchester, Franklin Co. (MCZ); Richland Creek, Wales, Giles Co. (CM). *Alabama*: Elk River, Fayetteville, Lincoln Co. (MCZ).

Tennessee River Drainage. *Alabama*: Shoals Creek, Lauderdale Co.; Tennessee River, Muscle Shoals, Colbert and Lauderdale Cos. (*both* MCZ); Pickwick Basin, mounds between Barton, Colbert Co. and Waterloo, Lauderdale Co. (Morrison, USNM).

Bear Creek Drainage. *Alabama*: Bear Creek, Burleson, Franklin Co. (CM).

Duck River Drainage. *Tennessee*: Duck River, Shelbyville, Bedford Co. (MZUM); Duck River, Wilhoite; Duck River, below Lillard Mill, Miltown; Duck River, Hardinsons Mill, 12 mi. NW Lewisburg; *all* Marshall Co. (*all* MCZ); Duck River, Leftwich (CM) and Columbia (MCZ), *both* Maury Co.

Cumberland River System

Cumberland River Drainage. *Kentucky*: Cumberland River, below Cumberland Falls, Whitely Co.; Rockcastle River, Mt. Victory; (*both* MZUM); Big South Fork, Parkers Lake Station (Wilson and Clark) and above Burnside (MZUM); *all* Pulaski Co.; Cumberland River, Horseshoe Bottom (MZUM); Beaver Creek, E Rowena Ferry (MCZ); *both* Russell Co. Cumberland River, Neeleys Ferry, Cumberland Co. (MZUM).

Obey River Drainage. *Tennessee*: Obey River, Pryor Bend, Pickett Co. (MCZ).

Caney Fork Drainage. *Tennessee*: Caney Fork [Smith Co.], (Wilson and Clark).

Harpeth River Drainage. *Tennessee*: Harpeth River, 10 mi. W Franklin, Williamson Co.; Harpeth River, Davidson Co. (*both* MCZ).

Plagiola (*Torulosa*) *florentina* (Lea)

Plate 13, figures 5–14
Distribution: Plate 2

Unio florentinus Lea 1857, Proc. Acad. Nat. Sci. Phila. 9: 83 ([Tennessee River], Florence, [Lauderdale Co.], Alabama; Cumberland River, Tennessee); 1861, Jour. Acad. Nat. Sci. Phila. (2) 5: 64, pl. 5, fig. 213, figured holotype USNM 84948 from the former locality; 1862, Obs. Unio 8: 68.

Unio saccatus Küster 1862, Conch. Cabinet (2) 9, pt. 2, p. 263, pl. 89, fig. 2 (Tennessee, figured type, location unknown).

Unio sacculus Reeve 1864, Conch. Iconica 16, *Unio*, pl. 15, species 67 (North America, figured type, British Mus. Nat. Hist. [lost]). Anthony, 1865, Amer. Jour. Conch. 1: 157, pl. 12, fig. 3 (Tennessee, figured holotype MCZ 161898). Anthony sent H. Cuming a specimen of his species before publication, which Reeve described before Anthony.

Truncilla walkeri Wilson and Clark 1914, U. S. Bur. Fisheries, Doc. no. 781, p. 46, pl. 1, fig. 1

(East Fork of Stones River, near Walterville [=Walterhill, Rutherford Co.], Tennessee, since the two figured syntypes could not be located in the USNM, a lectotype is here selected from a series of syntypes in the Museum of Zoology, University of Michigan 90729, pl. 13, fig. 9). Ortmann, 1918, Proc. Amer. Philos. Soc. 57: 592.

Truncilla curtisii Frierson and Utterback 1916, Amer. Mid. Nat. 4: 453 (190), pl. 6, fig. 14a–d, pl. 28, fig. 109 A–D (White River, Hollister, [Taney Co.], Missouri, the two figured syntypes are lost, a lectotype is here selected from a series collected by Frierson and Utterback in the White River, Forsyth, Taney Co., Missouri, Museum of Zoology, University of Michigan 90748, pl. 13, fig. 10).

Truncilla (Pilea) florentina (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 524 [partim]; 1914, Cat. Naiades 1: 30 [partim]. Wilson and Clark, 1914, U. S. Bur. Fisheries, Doc. 781, p. 46.

Dysnomia (Pilea) florentina (Lea). Ortmann, 1925, Amer. Mid. Nat. 9: 362.

Dysnomia (Capsaeformis) florentina (Lea). 1927, Check list N American naiades, p. 95. Haas, 1969, Das Tierreich, pt. 88, p. 488.

Description. Shell of medium size, seldom reaching over 60 mm in length. Outline elliptical or irregularly obovate. Valves somewhat inequilateral, subinflated, subsolid. Anterior end regularly rounded, posterior end of male slightly produced; posterior more broadly rounded in females. Ventral margin slightly but uniformly curved in the male; almost straight in females to the sulcus, behind which the marsupial swelling extends well below the base. Dorsal margin straight, forming an angle with the obliquely descending posterior margin. Hinge ligament short. Posterior ridge of the male, double, but faint, ending in a slight biangulation posteriorly; ridge scarcely visible in females. There is a wide shallow radial depression in front of the full, lower posterior ridge in the male. The considerable marsupial swelling of the female is usually marked by a sulcus before and behind and is sometimes finely toothed on the margin.

Umbos quite full and elevated, located slightly anterior of the middle in the male, and in the anterior third of the shell in the female, umbonal sculpture not observed. Surface of the shell with uneven growth lines. Periostracum subshiny, yellow, honey yellow, brownish yellow or whitish with numerous green rays more or less uniformly distributed over the entire surface.

Left valve with two chunky triangular pseudocardinal teeth; slight interdentum. Two short slightly curved lateral teeth. Right valve with one large triangular pseudocardinal tooth, usually with a smaller tooth before it that is parallel to the hinge line. One lateral tooth, sometimes with a vestigial tooth below. Umbonal cavities shallow. Anterior adductor muscle scars well impressed, posterior ones shallow. Pallial line distinct anteriorly. Nacre bluish white. Shell heavier anteriorly, posterior end of females especially thin and iridescent.

Male shells irregularly elliptical, with a double posterior ridge that ends in a slight bimargination near the median. There is a wide, shallow, radial depression in front of the full, lower posterior ridge.

Female shells irregularly obovate with a thin, slightly inflated marsupial swelling, which may be considerably produced and extended well below the base, often marked by two distinct sulci, toothed on the margin.

Length mm	Height mm	Width mm	
54	39	24	Stones River, 7 mi. NE Murfreesboro, Rutherford Co., Tennessee. Male.
49	38	21	As above. Female.

Remarks. Plagiola florentina (Lea) most closely resembles *P. capsaeformis.* The male of the former is shorter, higher and more swollen than that of *capsaeformis* and has a distinct wide shallow radial depression in front of the lower posterior ridge. This depression is very faint or wanting in *capsaeformis.* The female *florentina* has more strongly developed and more numerous denticulations on the margin of the marsupial expansion, and is more convex than *capsaeformis.* The two species are most readily separated by the color of the

surface—*florentina* is light yellow, honey colored, yellowish brown, or whitish, and is rather uniformly rayed over the entire surface; *capsaeformis* is green or greenish brown, and while the male is rather uniformly rayed, the marsupial area of the female is a darker green.

Ortmann (1918: 592) noted that *walkeri* was a large, compressed *florentina*, and that it was probably only an ecophenotypic variant. He later (1924a: 36) concluded from the measurements of numerous samples that the obesity or diameter of the shell changed with the size of the river—the larger rivers have the more swollen *florentina*, and the smaller rivers have the more compressed *walkeri*. In spite of Ortmann's observations, *walkeri* has continued to be promulgated in the literature as if it had nomenclatorial standing.

Truncilla curtisi Frierson and Utterback from the Ozark Plateau was recognized by Stansbery (1971: 18e) as a subspecies on the basis that his specimens were nearly white (pers. comm.). Utterback (1916: 453 [190]) mentioned that the epidermis of his specimens was yellowish brown and finely and obscurely radiate all over. Because of its geographical isolation, *curtisi* might be recognized as a subspecies as presently understood, but this does not seem warranted on morphological differences.

Anatomy. Described by Utterback (1916: 453 [190]).

Range. Upper White River system, Missouri; Tennessee River system, Virginia, Tennessee, and Alabama; Cumberland River system, Kentucky and Tennessee.

Abundance. "Now restricted in the Cumberland River system to the lower Stones and Red Rivers [as *D. f. walkeri*] and apparently gone from the entire Tennessee River system save the South Fork of the Holston in Virginia," (Stansbery 1970: 20). Collected in small numbers in the Black River, Missouri by C. B. Stein in 1964. Listed as "extirpated" by Stansbery (1976: 43, 51).

Specimens Examined

White River System

White River Drainage. *Missouri*: White River, Hollister, (Utterback); White River, Forsyth, (MZUM); *both* Taney Co.

Black River Drainage. *Missouri*: Black River, Hendrickson, Butler Co. (MCZ, OSM).

Tennessee River System

Holston River Drainage. *Virginia*: Middle Fork, Chilhowie, Smyth Co. (CM; Stansbery, OSM); Middle Fork, 3.7 mi. S Glade Spring (MCZ); South Fork, Barron (CM); *both* Washington Co. *Tennessee*: South Fork, Emmett, Sullivan Co.; Holston River, Holston Station, Grainger Co.; Holston River, Knox Co. (*all* CM).

Flint River Drainage. *Alabama*: Flint River, Maysville and Gurley; Hurricane Creek, Gurley; *all* Madison Co. (*all* CM).

Limestone Creek Drainage. *Alabama*: Limestone Creek, Mooresville, Limestone Co. (MZUM).

Tennessee River Drainage. *Alabama*: Tennessee River, Muscle Shoals, Colbert and Lauderdale Cos. (CM); Cypress Creek, Florence, (MZUM); Tennessee River, Florence, (MCZ); *both* Lauderdale Co. Pickwick Basin, mounds between Barton, Colbert Co. and Waterloo, Lauderdale Co. (Morrison, USNM).

Bear Creek Drainage. *Alabama*: Bear Creek, Burleston, Franklin Co. (MZUM).

Duck River Drainage. *Tennessee*: Duck River, Lillards Mills, Wilhoite, Marshall Co. (CM); Duck River, Columbia, Maury Co. (MCZ).

Cumberland River System

Cumberland River Drainage. *Kentucky*: Buck Creek, 2.1 mi. NE Mt. Victory (MCZ); Cumberland River, Burnside (CM); *both* Pulaski Co.; Beaver Creek, near mouth, (MZUM); Cumberland River, Indian Creek Bar (Wilson and Clark);

Cumberland River, Horseshoe Bottom, 5 mi. S Jamestown (MZUM); *all* Russell Co.

Obey River Drainage. *Tennessee*: Obey River, Duncan Ford, 4 mi. SE Lilydale, Pickett Co. (MCZ).

Stones River Drainage. *Tennessee*: East Fork, Stones River, Walterhill; Stones River, 7 mi. NNE Murfreesboro; *both* Rutherford Co. (*both* MCZ); Stones River, 1.2 mi. W Couchville, Davidson Co. (MCZ).

Harpeth River Drainage. *Tennessee*: Harpeth River, Belleview, Davidson Co. (CM).

Red River Drainage. *Tennessee*: Lower Red River [Montgomery Co.] (Stansbery, OSM).

Plagiola (*Torulosa*) *turgidula* (Lea)

Plate 14, figures 1–6

Distribution: Plate 2

Unio turgidulus Lea 1858, Proc. Acad. Nat. Sci. Phila. 10: 40 (Cumberland River, Tennessee; [Tennessee River], Florence, [Lauderdale Co.], Alabama); 1861, Jour. Acad. Nat. Sci. Phila. (2) 5: 62, pl. 5, fig. 211, figured holotype USNM 84946 from the former locality; 1862, Obs. Unio 8: 66.

Unio nux Küster 1861, Conch. Cabinet (2) 9, pt. 2, p. 218, pl. 73, fig. 2 (Alabama, figured type, [location unknown]) *non* Lea 1852.

Unio deviatus Reeve 1864, Conch. Iconica 16, Unio, pl. 15, species 61 ([Tennessee], figured holotype British Mus. Nat. Hist. 1965210). Anthony, 1865, Amer. Jour. Conch. 1: 156, pl. 12, fig. 2 (Tennessee, figured holotype MCZ 161895). Anthony sent H. Cuming a specimen of his species before publication, which Reeve described before Anthony.

Truncilla lefevrei Utterback 1916, Amer. Mid. Nat. 4: 455 [192], pl. 6, figs. 13 a–d, pl. 28, figs. 108 A–D (Black River, Williamsville, [Wayne Co.], Missouri, figured syntypes [lost]).

Truncilla (*Pilea*) *deviata* (Reeve). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 524; 1914, Cat. Naiades 1: 32.

Truncilla (*Pilea*) *florentina* (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 524 [partim]; 1914, Cat. Naiades 1: 32 [partim].

Truncilla turgidula (Lea). Ortmann, 1918, Proc. Amer. Philos. Soc. 57: 590.

Dysnomia (*Pilea*) *turgidula* (Lea). Ortmann and Walker, 1922, Occ. Papers, Mus. Zool., Univ. Michigan no. 112, p. 69. Ortmann, 1924, Amer. Mid. Nat. 9: 34; 1925, Amer. Mid. Nat. 9: 361.

Dysnomia (*Capsaeformis*) *turgidula* (Lea). Frierson, 1927, Check list N American naiades, p. 95. Haas, 1969, Das Tierreich, pt. 88, p. 490.

Dysnomia biemarginata turgidula (Lea). Stansbery, 1970, Malacologia 10: 20.

Dysnomia turgidula (Lea). Stansbery 1971, Symposium of rare and endangered moll. U. S., p. 18b, fig. 19. Van der Schalie, 1973, Sterkiana no. 52, p. 52.

Dysnomia (*Capsaeformis*) *lefevrei* (Utterback). Frierson, 1927, Check list N American naiades, p. 95. Haas, 1969, Das Tierreich, pt. 88, p. 489.

Description. Shell rather small, seldom reaching more than 40 mm in length. Outline elliptical, ovate or obovate. Valves inequilateral, solid, slightly inflated. Anterior end regularly rounded; posterior end of male rather pointed, of female more broadly rounded. Ventral margin curved in males, almost straight in females before the marsupial swelling. Dorsal margin slightly curved forming an indistinct angle with the obliquely descending posterior margin. Hinge ligament short. Posterior ridge of the male, double, somewhat raised, ending posteriorly in a slight biangulation. The ridges of the female fade out on the marsupial swelling. Dorsal slope slightly concave. The male has a rather wide, shallow, radial furrow, which ends in an emargination. The medial ridge is only slightly developed, and both it and the radial furrow are obscured in females by marsupial swelling. Umbos moderately full and elevated, located in the anterior third of the shell; umbonal sculpture not observed. Surface of the shell with irregular growth lines, which are especially strong on the female posteriorly. Periostracum rather shiny, yellowish green, with numerous fine green rays over the entire surface.

Left valve with two small, rough, subcompressed pseudocardinal teeth. No interdentum. Two short, straight, lateral teeth. Right valve with one small, triangular, pseudocardinal tooth, with a second tiny tooth before it that is parallel to the hinge line. One lateral tooth. Umbonal

cavities shallow. Anterior adductor muscle scars well impressed; posterior scars faint. Pallial line distinct anteriorly. Nacre bluish white. Shell heavier anteriorly, posterior end of females especially thin and irridescent.

Male shells are elliptical or ovate, with a distinct raised double posterior ridge, which ends in a biangulation near the base. Before the ridge is a wide shallow radial furrow and faint medial ridge.

The female is somewhat obovate, and while the marsupial swelling obliterates the radial furrow and the medial and posterior ridges, there is a tendency for the shell to be somewhat concave in the region of the posterior ridges. The surface of the marsupial swelling is not different from the rest of the shell, the feeble green rays are rather evenly distributed in both sexes.

Length mm	Height mm	Width mm	
41	29	22	Holston River, Knox Co., Tennessee. Male.
39	25	18	Tennessee. Female. Holotype of *Unio deviatus* Anthony.

Remarks. Plagiola turgidula (Lea) most closely resembles *P. biemarginata*, but the former has a more delicate, more elongate shell. The male of *turgidula* differs from that of *biemarginata*, in that the former has a less pronounced posterior and medial ridge and the radial furrow is not as deep as in the latter. Further, the posterior ridge of *turgidula* ends higher on the posterior margin than does that of *biemarginata*.

The female *turgidula* resembles the females of the other members of subgenus *Capsaeformis*, with its inflated, outcurved, marsupial expansion in the area occupied by the radial furrow in the male. However in *turgidula* alone is there no color difference between the disk and the marsupial swelling. Light green rays uniformly cover the entire surface, except sometimes the extreme anterior.

The male of this species was described by Lea and the female, later, by Reeve. Walker (1910: 81) was first to recognize the two sexes as the same species. This is the species described by Utterback as *lefevrei* from the Ozark Plateau. He refers to the male shell as having a post-umbonal ridge, rather biangulated and with a very slight radial furrow in front. *P. turgidula* had been collected before 1914 on the Ozark Plateau from Spring Creek, Hardy, Sharp County, Arkansas, and so noted by Simpson (1914; 1: 32).

The presence of *P. turgidula*, like that of *florentina* on the Ozark Plateau, is evidence of a former connection of that area with the Cumberland Plateau.

Anatomy. Described by Utterback (1916: 457 [192]).

Range. Upper White River system, Missouri and Arkansas; Tennessee River system, Tennessee and Alabama; Cumberland River system.

Abundance. This species is known from the Cumberland River, only on the authority of Lea and from a specimen, so labeled, in the British Museum (Nat. Hist.). It was once widely distributed throughout the Tennessee River system, but according to Stansbery (pers. comm.), it is now restricted to the Duck River, in the vicinity of Normandy, Bedford County, Tennessee.

Listed a "extirpated" by Stansbery (1976: 43, 51).

Specimens Examined

White River System

White River Drainage. *Missouri*: White River, Moores Ferry [not located, but probably in Stone or Taney Co.] (MZUM).

Black River Drainage. *Arkansas*: [Spring River], Hardy, Sharp Co. (MZUM; MCZ, *ex* MZUM; Field Museum, Chicago). *Missouri*: Black River, Williamsville, Wayne Co. (Utterback).

Tennessee River System

Clinch River Drainage. *Tennessee*: Clinch River (MCZ); Emory River, Harriman, Roane Co. (CM).

Holston River Drainage. *Tennessee*: Holston River, Rogersville (MZUM); Holston River, Austin Mill (CM); *both* Hawkins Co.; mouth of Holston River, Austins Grist Mill, Knox Co. (MCZ).

Elk River Drainage. *Tennessee*: Elk River (Stansbery, OSM).

Tennessee River Drainage. *Alabama*: Shoals Creek (Hinkley and Marsh); Tennessee River, Florence (Lea, USNM); *both* Lauderdale Co.

Bear Creek Drainage. *Alabama*: Bear Creek, Burleson, Franklin Co. (CM).

Duck River Drainage. *Tennessee*: Duck River, Normandy (Stansbery, OSM); Shelbyville (CM); *both* Bedford Co. Duck River, Columbia, Maury Co. (Hinkley and Marsh).

Cumberland River System

Cumberland River Drainage. Cumberland River (Lea, USNM; BMNH).

Subgenus *Pilea* Simpson

Pilea Simpson 1900, Proc. U. S. Natl. Mus. 22: 522. Type species, *Unio personatus*, original designation.

Scalenilla Ortmann and Walker 1922. Occ. Papers, Mus. Zool., Univ. Mich. no. 112, p. 68. Type species, *Unio sulcatus* Lea, original designation.

Obliquata Frierson, 1927, Check list N American naiades, pp. 10, 52. Type species, *Obliquaria* (*Scalenaria*) *obliquata* Rafinesque, original designation, *teste* Errata et Corrigenda.

Description. Shell subtriangular or subquadrate. "Male shell with a wide, shallow, radiating depression in front of the posterior ridge, that of the female with a rounded, foliaceous swelling at the posterior base. Animal with post basal flap of mantle of female very heavy; ovisacs not extending to the top of the marsupium." (Simpson).

Remarks. Frierson (1927: 96) restricted Simpson's subgenus *Pilea* to include *personatus* and *sulcatus* (= *obliquata*), but *haysianus* is now also included on the basis of shell morphology. All three of these species tend to be proportionally higher in relationship to length than any others in the genus. They all have relatively heavy shells, and have periostraca that are similarly shiny or subshiny, greenish yellow, or chestnut, with very fine green rays. Unlike other members of *Plagiola* they sometimes have purple or flesh-colored nacre. The depression in front of the posterior ridge in the male is a raised marsupial swelling in the female.

Key to the Species of *Pilea*

1. Shell subtriangular, subquadrate, or suborbicular 2
   Shell subtrapezoid or subquadrate, nacre white ..... *personata*
2. Periostracum subshiny, yellowish brown or greenish, nacre usually purplish ..... *obliquata*
   Periostracum shiny, tawny to chestnut, nacre purplish ..... *haysiana*

Plagiola (*Pilea*) *personata* (Say)
Plate 14, figures 7–9
Distribution: Plate 6, figure B

Unio personatus Say 1829, New Harmony [Indiana] Disseminator 2 (20): 309 (Wabash River, [Indiana]; neotype MCZ 5763 from the Cumberland River, Tennessee, selected by Johnson and Baker, 1973, Proc. Acad. Nat. Sci. Phila. 125: 166, pl. 8, fig. 5).

Unio pileus Lea 1831, Trans. Amer. Philos. Soc. 4: 119, pl. 18, fig. 47 (Ohio River, near Cincinnati [Hamilton Co.], Ohio, figured holotype USNM 84602a); 1834, Obs. Unio 1: 129.

Unio capillaris Lea 1834, Trans. Amer. Philos. Soc. 5: 29, pl. 2, fig. 2 (Ohio, figured type [lost], specimen subsequently identified by Lea USNM 84602); 1834, Obs. Unio 1: 141.

Truncilla (*Pilea*) *personata* (Say). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 522; 1914, Cat. Naiades 1: 23; 1903, Daniels, 27th Ann. Rept. Dept. Geol. and Nat. Res. of Indiana, p. 646.

Dysnomia (*Pilea*) *personata* (Say). Ortmann, 1925, Amer. Mid. Nat. 9: 361. Frierson, 1927, Check list N American naiades, p. 96, Haas, 1969, Das Tierreich, pt. 88, p. 480.

Dysnomia personata (Say). Morrison, 1942, Bur. Amer. Ethnology, Bull. no. 129, p. 364. Goodrich and van der Schalie, 1944, Amer. Mid. Nat. 32: 314. La Rocque, 1967, Geol. Surv. Ohio, Bull. no. 62 (2): 278, fig. 169. Stansbery, 1970, Malacologia 10: 19; 1971, Symposium of rare and endangered moll. U. S., p. 18a, figs. 11, 12.

Description. Shell of medium size, reach-

ing up to 65 mm in length. Outline subtriangular or subquadrate. Valves inequilateral, solid, inflated. Anterior end regularly rounded, sometimes subtruncate in the male; posterior end of male regularly rounded or subtruncate; posterior in females slightly produced above the median. Ventral margin curved with a slight emargination posteriorly in the male. Dorsal margin straight, forming an angle with the obliquely descending posterior margin. Hinge ligament short. Posterior ridge faintly double in males, ending in a slight bimargination, separated from a faint medial ridge by a narrow radial sulcus, which ends in a slight emargination. The area of the sulcus is a raised swelling marked by denticulations in the female. Dorsal slope slightly concave. Umbos full, somewhat elevated and prominent, slightly turned over a distinct lunule, located near the middle of the male shell and in the anterior third of the female. Surface of the shell irregularly concentrically sculptured. Periostracum often silky or clothlike, greenish yellow, brownish, or greenish brown in old shells, usually with faint wavy green rays over most of the surface.

Left valve with two chunky triangular pseudocardinal teeth; slight interdentum. Two short, almost straight, lateral teeth. Right valve with one large triangular pseudocardinal tooth, usually with a small tooth before it, and sometimes with a much smaller tooth after it. One lateral tooth, sometimes with a vestigial tooth below. Umbonal cavities shallow. Anterior and posterior muscle scars well impressed. Pallial line distinct anteriorly. Nacre white or flesh colored. Shell heavier anteriorly, marsupial area of the female quite thin.

Male shells are subtriangular with a double posterior ridge that ends in a biangulation in front of which is a narrow, shallow radial depression that ends in a slight emargination.

Female shells are subquadrate, the marsupial swelling occupies the place of the radial depression. It is rather small, and only slightly inflated, but it is radially sculptured, denticulated, thin and excavated within. Reaches the same size as the male shell.

Length mm	Height mm	Width mm	
47	47	30	Ohio River, Cincinnati, Hamilton Co., Ohio. Male.
53	48	35	As above. Female.

Habitat. Lives in deeper water [deeper than what?] *teste* Morrison (1942: 364).

Remarks. Plagiola personata (Say) most closely resembles *P. obliquata.* Both the male and the female of the former have proportionally higher shells. The radial furrow in the male *personata* is more developed than is that of *obliquata.* The female of *personata* has a slightly raised marsupial swelling, whereas that of *obliquata* is separated from the rest of the shell by two distinct sulci.

Range. Tennessee River system, Tennessee and Alabama; Cumberland River system, Tennessee; Ohio River system, from the lower Wabash drainage to Cincinnati, Hamilton County, Ohio.

Abundance. "I know of no collections of this species made in this century. It is presumed extinct." (Stansbery, 1976: 43, 50)

Specimens Examined

Tennessee River System

Clinch River Drainage. *Tennessee*: Clinch River (MCZ, MZUM).

Tennessee River Drainage. *Alabama*: Tennessee River, Muscle Shoals, Colbert and Lauderdale Cos. (CM); Tennessee River, Florence, Lauderdale Co. (MCZ, MZUM); Pickwick Basin, mounds between Barton, Colbert Co. and Waterloo, Lauderdale Co. (Morrison, USNM).

Cumberland River System

Cumberland River Drainage. *Tennessee*: Cumberland River (MCZ); Cumberland River, near Priestly Shoals, Davidson Co. (MZUM).

Ohio River System

Wabash River Drainage. *Indiana*: White River (MZUM); Wabash River (MCZ); Wabash River, New Harmony, Posey Co. (Daniels).

Ohio River Drainage. *Ohio*: Ohio River, Cincinnati, Hamilton Co. (MCZ, OSM, MZUM).

Plagiola (*Pilea*) *obliquata* (Rafinesque)
Plate 14, figures 10–12
Distribution: Plate 4

Obliquaria obliquata Rafinesque 1820, Ann. Gén des Sci. Physiques, Bruxelles 5: 309 (le Kentuky [River]; lectotype ANSP 20226, selected by Johnson and Baker, 1973, Proc. Acad. Nat. Sci. Phila. 125: 163, pl. 7, fig. 1).

Unio sulcatus Lea 1829, Trans. Amer. Philos. Soc. 3: 430, pl. 9, fig. 12 (Ohio, figured holotype USNM 84803); 1834, Obs. Unio 1: 44.

Unio ridibundus Say, 1829, New Harmony [Indiana] Disseminator 2 (5): 308; 1830, Amer. Conch. no. 1, pl. 5 (Cumberland River [Tennessee], figured type [lost]).

Unio perplexus Say 1829, New Harmony [Indiana] Disseminator 2 (5): 309; 1830, American Conch. no. 1 [letterpress to pl. 5] (Cumberland River [Tennessee], type [lost]), *non* Lea 1831.

Unio flagellatus Say 1830, Amer. Conch. no. 1 [letterpress to pl. 5]. Listed as a synonym of *Unio sulcatus* Lea.

Unio pectitis Conrad 1853, Proc. Acad. Nat. Sci. Phila. 6: 255 [nomen nudum]; 1854, Jour. Acad. Nat. Sci. Phila. (2) 2: 297, pl. 27, fig. 4 (Wabash River [Indiana], type not located).

Unio stewardsonii stewensoni Gregorio 1914, Il Nat. Siciliano 22: 45, pl. 6, fig. 3 (no locality, type presumed to be in Palermo Mus., Sicily [not seen]).

Unio propesulcatus Gregorio 1914, Il Nat. Siciliano 22: 60, pl. 10, fig. 2 (Cumberland River, Tennessee, type presumed to be in Palermo Mus., Sicily [not seen]).

Truncilla (*Scalenaria*) *sulcata* (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 520; 1914, Cat. Naiades 1: 14.

Truncilla sulcata (Lea). Wilson and Clark, 1912, U. S. Bur. Fisheries, Doc. 757: 31, 37, 38, 55. Wilson and Clark, 1914, U. S. Bur. Fisheries, Doc. 781: 46. Walker, 1918, Mus. Zool., Univ. Mich., Misc. Pub. no. 8: 186.

Dysnomia (*Scalenilla*) *sulcata* (Lea). Ortmann and Walker, 1922, Occ. Papers, Mus. Zool., Univ. Mich., no. 112, p. 68. Ortmann, 1925, Amer. Mid. Nat. 9: 360. La Rocque, 1967, Geol. Surv. Ohio, Bull. no. 62 (2): 278, fig. 171.

Dysnomia (*Pilea*) *sulcata* (Lea). Frierson 1927, Check list N American naiades, p. 96. Haas, Das Tierreich, pt. 88, p. 480.

Dysnomia sulcata (Lea). Morrison, 1942, Bur. Amer. Ethnology, Bull. no. 129, p. 364. Goodrich and van der Schalie, 1944, Amer. Mid. Nat. 32: 314. Neel and Allen, 1964, Malacologia 1: 450. Stansbery, 1970, Malacologia 10: 19; 1971, Symposium of rare and endangered moll. U. S., p. 18e, figs. 43, 44. Clark, 1977, Sterkiana, nos. 65, 66, p. 27, fig. 19.

Dysnomia sulcata perobliquus Stansbery, 1970, Malacologia 10: 19, *non* Conrad 1836.

Description. Shell of medium size, reaching up to 70 mm in length. Outline subtrapezoid or quadrate. Valves very inequilateral, inflated, solid. Anterior end of male decidedly subtruncate, regularly rounded in the female; posterior end of male somewhat produced and pointed, truncate in the female. Ventral margin broadly curved in males, almost straight in females. Dorsal margin long and almost straight, forming an angle with the obliquely descending posterior margin. Hinge ligament rather long. Posterior ridge of the male double, rather low and faint, separated by a wide faint radial furrow before another faint ridge. Posterior ridge of female, somewhat obscured before a sharp sulcus before the marsupial swelling. Dorsal slope of male very narrow, wider in the female. Umbos full, elevated and prominent, turned over a small lunule, located at the extreme anterior end, their sculpture consisting of a few corrugations. Surface of the shell with numerous strong growth rests. Periostracum smooth and shiny, or subshiny, yellowish, greenish yellow or brownish, usually feebly rayed over the entire surface.

Left valve with two chunky triangular, pseudocardinal teeth; slight interdentum. Two short straight lateral teeth. Right valve with one large triangular pseudocardinal tooth, usually with a much smaller tooth before and behind it. One lateral tooth, sometimes with a vestigial tooth below. Anterior and posterior muscle scars and pallial line well impressed. Shell thinner posterior-

ly in the female in the area of the marsupial swelling. Nacre purplish, pink, bluish white or white.

Male shells are usually much larger than those of the female, and are subtrapezoid. The dorsal and ventral margins are curved, but the anterior margin is subtruncate. The posterior end is pointed bluntly above, and is slightly truncate below. The lower posterior ridge is rather widely separated from the medial ridge by a faint furrow.

Female shells are subquadrate, and truncated posteriorly. The marsupial area, which occupies the space between the lower posterior and medial ridges in the male, is inflated, rounded and separated from the rest of the shell by two sulcations, the more posterior being the more acute and ending in a more acute emargination. The marsupial area is toothed and is sculptured by former teeth at rest stops.

Length mm	Height mm	Width mm	
55	41	33	Ohio River, Cincinnati, Hamilton Co., Ohio. Male.
35	28	24	Cumberland River, Tennessee. Female.

Remarks. Plagiola obliquata (Rafinesque) most closely resembles *P. personata*, under which see: *Remarks*. The male shell of *personata* is subtriangular, while that of *obliquata* is subtrapezoid. The umbos of the latter project much farther forward than do those of the male *personata* or of the female *obliquata*, often reaching the extreme anterior end as in *Pleurobema clava* (Lamarck). The female of *obliquata* has a marsupial swelling that is separated from the rest of the shell by two distinct sulci.

Stansbery (1970: 19) regarded *Unio gibbosus perobliquus* Conrad as a geographically isolated subspecies from the streams tributary to western Lake Erie and Lake St. Clair on the basis of its having a white nacre. Nacre color appears to be an ecophenotypic variation which changes from purple to white throughout the range of *P. obliquata*. The figured type of *perobliquus* is *P. torulosa* (Rafinesque).

Ortmann and Walker (1922: 68) pointed out that the original description of *obliquata* applied as well to *Pleurobema pyramidatum* (Lea) as to *Unio sulcatus* Lea, and made the reasonable suggestion that *obliquata* be dropped as unidentifiable. Frierson (1927: 53) argued that *obliquata* was *pyramidatum* (Lea). He was followed by Haas (1969: 297) and Morrison (1969: 24). Since the lectotype of *obliquata* is *sulcata* (Lea), the former taxon must, unfortunately, replace Lea's well-known name.

Morrison (1969: 24) mentioned that *Unio sulcatus* Lea 1829 is preoccupied, and indicated that this taxon should be replaced by *Plagiola ridibundus* (Say) 1829. Morrison did not say by whom *sulcatus* was preoccupied and a careful search of the literature did not afford the answer, but this is now of no interest here.

Range. Tennessee River system, Tennessee and Alabama; Cumberland River system, Kentucky and Tennessee; Ohio River system: Wabash River Drainage, and Ohio River, to the Scioto River drainage, Ohio; St. Lawrence River system: Lake Erie drainage.

Abundance. As early as 1912, Wilson and Clark (p. 31) were able to find only one live specimen of *P. obliquata* in an extensive survey of the Maumee River drainage. Still occasionally found in streams tributary to western Lake Erie or Lake St. Clair (Stansbery, 1970: 19 as *D. sulcata perobliquus*), and the Green River, Kentucky (Stansbery, 1971: 18e). *Epioblasma sulcata sulcata* is listed as "extirpated" by Stansbery (1976: 43, 50).

Specimens Examined

Tennessee River System

Tennessee River Drainage. *Alabama*: Tennessee River, Muscle Shoals, Lauderdale and Colbert Cos. (CM); Tennessee River, Florence, Lauderdale Co. (MZUM); Tennessee River, Tuscumbia, Colbert Co. (MCZ); "Mound about 3 mi. WSW Gravelly Springs, Lauderdale Co., only this speci-

men found in all mounds studied" (Morrison, 1942).

Cumberland River System

Cumberland River Drainage. *Kentucky*: Cumberland River, Burnside, Pulaski Co.; Cumberland River, Neceleys Ford, 4 mi. S Burksville, Cumberland Co.; (*both* MZUM). *Tennessee*: Cumberland River, Fort Blount, 6 mi. SW Jamesboro, Jackson Co. (MZUM); Cumberland River, Goodall Island, Smith Co. (Wilson and Clark).

Caney Fork Drainage. *Tennessee*: Caney Fork, Buffalo Valley, Putnam Co. (Wilson and Clark).

Cumberland River Drainage. *Tennessee*: Cumberland River, Nashville, Davidson Co. (MCZ); Cumberland River, Halfpone Bar, Cheatham Co. (Wilson and Clark).

Harpeth River Drainage. *Tennessee*: Harpeth River (MZUM).

Ohio River System

Ohio River Drainage. *Illinois*: Ohio River (Baker).

Wabash River Drainage. *Indiana*: White River (MCZ); West Fork, White River (Daniels); White River, Indianapolis (MZUM); *both* Marion Co.; White River, Rockford, Jackson Co. (Daniels); Wabash River, Lafayette, Tippecanoe Co. (MCZ and MZUM); Wabash River, New Harmony, Posey Co. (MZUM).

Green River Drainage. *Kentucky*: Green River, Glenmore, Warren Co. (OSM); Green River, Rochester, Butler Co. (MCZ; MZUM).

Kentucky River Drainage. *Kentucky*: Kentucky River (Rafinesque).

Ohio River Drainage. *Ohio*: Ohio River, Cincinnati, Hamilton Co. (MCZ).

Licking River Drainage. *Kentucky*: Licking River (MCZ).

Scioto River Drainage. *Ohio*: Scioto River (MZUM).

St. Lawrence River System

Great Lakes Drainage. (Lake Erie) *Ohio*: Blanchard River, Findlay, Hancock Co. (MZUM); Fish Creek, Williams Co. (Clark, 1977: 21). *Indiana*: St. Joseph River (MZUM); St. Marys River (Wilson and Clark); Maumee River (MCZ, MZUM); *both* Fort Wayne, *all* Allen Co. *Ohio*: Maumee River, 4 mi. below Defiance; Auglaise River, 4 mi. above Defiance; *both* Defiance Co. (*both* Wilson and Clark). Lake Erie, Putin Bay, Ottawa Co. (Wilson and Clark). *Michigan*: Otter Creek, Monroe Co. (MZUM). Lake St. Clair (Stansbery, 1970). Detroit River, Belle Island, Wayne Co. (MZUM). *Ontario*: Detroit River, Bois Blanc Isle, Essex Co. (MZUM). *Michigan*: Lake Erie, near Stony Creek; River Rasin; Lake Erie, La Plaisance Bay; *all* Monroe Co. (*all* MZUM). *New York*: Niagara River (MZUM).

Plagiola (*Pilea*) *haysiana* (Lea)

Plate 15, figures 1–4

Distribution: Plate 8, figure A

Unio haysianus Lea 1834, Trans. Amer. Philos. Soc. 5: 35, pl. 3, fig. 7 (Cumberland River [Tennessee], figured type [lost], male specimen, subsequently identified by Lea, USNM 84613 from the Cumberland River, Nashville, Davidson Co., Tennessee); 1834, Obs. Unio 1: 147.

Unio sowerbyanus Lea 1834, Trans. Amer. Philos. Soc. 5: 68, pl. 10, fig. 28 (Tennessee, figured type [lost], 4 male specimens, subsequently identified by Lea, MCZ 178886 from the Caney Fork of the Cumberland River, Tennessee); 1834, Obs. Unio 1: 180.

Truncilla (*Scalenaria*) *haysiana* (Lea). 1900, Proc. U. S. Natl. Mus. 22: 520; 1914, Cat. Naiades 1: 16.

Truncilla haysiana (Lea). Wilson and Clark, 1914, U. S. Bur. Fish. Doc. no. 781, p. 46. Ortmann, 1912, Ann. Carnegie Mus. 8: 357; 1913, Proc. Amer. Philos. Soc. 52: 311; 1918, Proc. Amer. Philos. Soc. 57: 587.

Dysnomia (*Scalenilla*) *haysiana* (Lea). Ortmann, 1925, Amer. Mid. Nat. 9: 361.

Dysnomia (*Penita*) *haysiana* (Lea). Frierson, 1927, Check list N American naiades, p. 94. Haas, 1969, Das Tierreich, pt. 88, p. 483.

Dysnomia haysiana (Lea). Morrison, 1942, Bur. Amer. Ethnology, Bull. no. 129, p. 364. Neel and Allen, 1964, Malacologia 1: 450, fig. 60. Stansbery 1970, Malacologia 10: 19; 1971, Symposium of rare and endangered moll. U. S., p. 18e, figs. 45, 46.

Epioblasma haysiana (Lea). Stansbery, 1972, Amer. Mal. Union, Bull. for 1972, p. 22.

Description. Shell usually of small size, reaching up to 40 mm in length. Outline subtriangular or suborbicular. Valves inequilateral, somewhat inflated, solid. Anterior end regularly rounded, posterior end of male somewhat elongate and slightly more broadly rounded; more broadly rounded in the female. Ventral margin curved. Dorsal margin curved merging almost imperceptibly with the obliquely descending posterior margin. Hinge ligament short. Posterior ridge of the male faint, but double, broadly curved or flat, merging into a flat dorsal slope; ridge elevated into a marsupial swelling in females. There is a broad, shallow radial furrow before a medial ridge in the male; the furrow is narrow and deep in the female. The posterior end of the male shows vestiges of teeth along the growth rests; these are prominent in the female especially on the marsupial swelling. Umbos full and high, located somewhat anteriorly, feebly sculptured. Surface of the shell smooth anteriorly, but sometimes rendered subnodulous by deep growth rests. Periostracum very shiny, especially anteriorly, tawny to chestnut, with a few greenish rays in the radial furrow and on the disk.

Left valve with two chunky, triangular pseudocardinal teeth of about equal size with a sharp, deep, triangular pit between them extending to the hinge line; interdentum short but wide. Two short straight lateral teeth. Right valve with one large, triangular, pseudocardinal tooth, sometimes with a vestigial tooth anterior to it. One well-developed lateral tooth, with a vestigial tooth below. Umbonal cavities shallow. Anterior and posterior muscle scars and pallial line well impressed. Marsupial area of the female thinner and somewhat excavated. Nacre usually purple, but sometimes white and iridescent posteriorly.

Male shells are subtriangular, often as high or higher than long. The radial furrow in front of the posterior ridge is broad and shallow. The posterior end has vestiges of teeth along the growth lines.

Female shells are suborbicular, less long than high. The posterior ridge is inflated, and extends below the ventral margin. The radial furrow in front of the posterior ridge is narrow, sharp and deep. The posterior end has more vestiges of sharper teeth along the growth lines than does the male.

Length mm	Height mm	Width mm	
40	31	21	Clinch River, Union Co., Tennessee. Male.
30	25	17	As above. Female.

Anatomy. Discussed by Ortmann (1912, 357).

Remarks. Plagiola haysiana (Lea) is easily distinguished from the other members of the genus by its polished, tawny to chestnut periostracum, its small size, its unusually thick and heavy shell, and its usually purplish nacre.

Lea described the female of this species as *U. haysianus* and the male as *U. sowerbyanus.*

Range. Tennessee River system, Virginia, Tennessee and Alabama; Cumberland River system, Kentucky and Tennessee.

Abundance. Now restricted to the Clinch River between St. Paul, Wise County, to Dungannon, Scott County, Virginia, a distance of only about 10 miles (Stansbery, 1970: 19). Listed as "extirpated" by Stansbery (1976: 43, 50).

Specimens Examined

Tennessee River System

Powell River Drainage. *Virginia*: Powell River, 2.5 mi. S Jonesville; Wallens Creek; Powell River, Lyttons Mill (*all* MCZ); Powell River, Pennington Gap (CM); *all* Lee Co.

Clinch River Drainage. *Virginia*: Clinch River, Raven, Tazewell Co. (CM); Clinch River, Cleveland, Russell Co. (MCZ); Clinch River, Saint Paul, Wise Co. (Stansbery, OSM); Clinch River, Dungannon, Scott Co. (MCZ). *Tennessee*: Clinch

River, Union Co.; Clinch River, Clinton, Anderson Co. (*both* MCZ).

Holston River Drainage. *Virginia*: North Fork, Hilton, Scott Co. (CM). *Tennessee*: South Fork, Pactolus, Sullivan Co. (CM); Mouth of Holston River, Austins Grist Mill, Knox Co. (MCZ).

Tennessee River Drainage. *Tennessee*: Tennessee River, near Knoxville, Knox Co. (MCZ).

Little River Drainage. *Tennessee*: mouth of Little River, Little River Shoals, Blount Co. (MCZ).

Little Tennessee River Drainage. *Tennessee*: Little Tennessee River, Monroe Co. (MCZ); Little Tennessee River, Coytee, Loudon Co. (MZUM).

Elk River Drainage. *Tennessee*: Elk River, Fayetteville, Lincoln Co. (MCZ). *Alabama*: Lower Elk River (Conrad).

Tennessee River Drainage. *Alabama*: Tennessee River, Florence, Lauderdale Co.; Tennessee River, Tuscumbia, Colbert Co. (*both* MCZ); Pickwick Basin, mounds between Barton, Colbert Co. and Waterloo, Lauderdale Co. (Morrison, USNM).

Cumberland River System

Cumberland River Drainage. *Kentucky*: Big South Fork, above Burnside and Parkers Lake Station; *both* Pulaski Co. (*both* MCZ). *Tennessee*: Cumberland River, Goodall Island, Smith Co. (Wilson and Clark).

Caney Fork Drainage. *Tennessee*: Caney Fork, [Smith Co.] (MCZ).

Cumberland River Drainage. *Tennessee*: Cumberland River, Nashville, Davidson Co. (MCZ; USNM); Cumberland River, Clarksville, Montgomery Co. (Wilson and Clark).

Subgenus *Epioblasma* Rafinesque

Epioblasma Rafinesque 1831, Cont. Monog. Bivalve Shells River Ohio, p. 2. Type species, *Epioblasma biloba* Rafinesque, monotypie.

Dysnomia Agassiz 1852, Arch. für Naturgesch. 18: 43. First species listed, [*Obliquaria*] *flexuosa* [Rafinesque] = *Unio foliatus* Hildreth [*teste* Agassiz]. Type species, *Unio foliatus* Hildreth, subsequent designation, Simpson, 1900, Proc. U. S. Natl. Mus. 22: 521.

Description. Shell subrhomboid, subquadrate or subtriangular. "Shell of the male with a posterior and central radiating ridge, with a wide, flattened space between them; that of the female with a greatly produced inflation, which is but a little behind the center of the base and which is a continuation of the central ridge" (Simpson, 1914: 18).

Remarks. The availability of *Epioblasma* over *Dysnomia* becomes of nugatory interest once both of these names are reduced to subgeneric standing under *Plagiola.* The availability of *Epioblasma* is dependent on the identification of *E. bioloba.* Frierson (1914: 7) asserted that *E. bioloba* Raf. = *U. foliatus* Hild. [=*flexuosa* Raf.]. In reply to Frierson, Ortmann and Walker (1922: 71) gave a number of palpable reasons why *bioloba* was not recognizable to them. In the index to his *Check list of North American naiades*, Frierson (1927: 101) indicated that *bioloba* belonged in the synonymy of *Dysnomia flexuosa* (Raf.) although he neglected to include it in the synomymy of the latter. He apparently forgot he had previously asserted the availability of *Epioblasma* over *Dysnomia.* Thiele (1934: 837), Clench (1959: 1157), Morrison (1969: 24), and Stansbery (1972: 22) recognize *Epioblasma.* The latter said (1973, pers. comm.), "*Epioblasma* [*bioloba*] Rafinesque 1831 is clearly the female of [*Obliquaria*] *flexuosa* Rafinesque 1820."

Van der Schalie (1973: 49) partially requoted Ortmann and Walker as to why *bioloba* is unrecognizable, merely reasserting their position. While no one has made any contribution to the subject of *bioloba*'s recognizability since Ortmann and Walker, most subsequent published opinions, as noted above, are that *bioloba* is identifiable and is the female of *flexuosa.*

The type and an authentic specimen sent to Férussac of *bioloba* are both lost (Johnson and Baker, 1973: 149), therefore in the

interests of stability of nomenclature, the "exceptional circumstances" [Int. Code Zool. Nomen., 1964, Art. 75 (a) (i)] described above require that a neotype be selected for *bioloba*. This is done under *Plagiola* (*Epioblasma*) *flexuosa* (Rafinesque).

Key to the Species of *Epioblasma*

Medial ridge considerably elevated ..... *flexuosa*
Medial ridge not much elevated ..... *stewardsoni*

Plagiola (*Epioblasma*) *flexuosa* (Rafinesque)

Plate 15, figures 5–8
Distribution: Plate 5

Obliquaria flexuosa Rafinesque 1820, Ann. Gén. Sci. Physiques, Bruxelles 5: 306 (le Kentuky, Salt-river et Green-river; lectotype ANSP 20249 from the Kentucky River, selected by Johnson and Baker, 1973, Proc. Acad. Nat. Sci. Phila. 125: 163, pl. 7, fig. 2).

Unio foliatus Hildreth 1828, American Jour. Sci. 14: 284, fig. 16 (Ohio; known only from the figured type [lost]).

Epioblasma biloba Rafinesque 1831, Cont. Monog. Bivalve Shells River Ohio, p. 2 (Green River and Kentucky River; type lost, *teste* Johnson and Baker, 1973, Proc. Acad. Nat. Sci. Phila. 125: 149). Neotype, here selected, ANSP 56571, pl. 15, fig. 7, and the type locality restricted to the Ohio River, near Cincinnati, Hamilton Co., Ohio).

Truncilla lewisi Walker 1910, Nautilus 24: 42, pl. 3, fig. 3 female; figs. 4, 5 male (Holston River, Tennessee, the figured female syntype is, here selected, lectotype MZUM 91456, pl. 15, fig. 8). Simpson, 1914, Cat. Naiades 1: 20. Ortmann, 1918, Proc. Amer. Philos. Soc. 57: 588.

Truncilla foliata (Hildreth). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 521; 1914, Cat. Naiades 1: 18.

Dysnomia (*Dysnomia*) *flexuosa* (Rafinesque). Ortmann and Walker, 1922, Occ. Papers, Mus. Zool. Univ. Michigan no. 122, p. 70. Ortmann, 1926, Ann. Carnegie Mus. 17: 183. Frierson, 1927, Check list N American naiades, p. 93. Goodrich and van der Schalie, 1944, Amer. Mid. Nat. 32: 314. La Rocque 1967, Geol. Surv. Ohio, Bull. 62 (2): 275, fig. 167. Haas, 1969, Das Tierreich, pt. 88, p. 478. Stansbery, 1970, Malacologia 10: 19, pl. 1, figs. 1, 2; 1971, Symposium of rare and endangered moll. U. S., p. 18a, figs. 5, 6.

Dysnomia (*Dysnomia*) *lewisi* (Walker). Frierson, 1927, Check list N American naiades, p. 93. Haas, 1969, Das Tierreich, pt. 88, p. 479.

Dysnomia flexuosa lewisi (Walker). Morrison, 1942, Bur. Amer. Ethnology, Bull. no. 129, p. 366.

Dysnomia lewisi (Walker). Neel and Allen, 1964, Malacologia 1: 450, figs. 61, 66. Stansbery 1970, Malacologia 10: 19; 1971, Symposium of rare and endangered moll. U. S., p. 18a, fig. 7 [fig. 8, after Walker, is a male of *E. stewardsoni*].

Description. Shell of medium size, reaching up to 75 mm in length. Outline of male subrhomboid or quadrate; outline of female, depending on the extent of marsupial swelling, subtriangular. Valves equilateral, slightly inflated, solid. Anterior end of the male shell regularly rounded, forming an obtuse angle at its junction with the basal emargination. Anterior end of the female regularly rounded, becoming straight and obliquely descending beyond the base line. Posterior end of the male subtruncated; that of the female somewhat extended and pointed. Ventral margin of the male with two slight emarginations; one considerable emargination in females. Dorsal margin broadly curved in males; margin short and straight in females, forming an obtuse angle with the obliquely descending posterior margin. Hinge ligament prominent. Posterior ridge distinct, rounded toward the umbos, becoming flattened and somewhat double as it approaches the posterior end, where it terminates in a slight biangulation projecting a little beyond the posterior and basal lines. Dorsal slope narrow and slightly concave. In front of a median groove is a strong anterior ridge that becomes more pronounced as it approaches the base, where it terminates in an angle slightly backward, at, or a little behind, the middle of the base. In the female this anterior ridge becomes an enormously produced lobe, or winglike marsupial swelling. Umbos laterally compressed, only slightly elevated above the hinge line, located near the middle of the shell, their sculpture faint and corrugated. Surface of the shell with uneven concentric sculpture. Periostracum uniformly pale brownish green or brownish, with faint green rays,

except for the female's marsupial swelling, which may be dark green.

Left valve with two ragged pseudocardinal teeth, triangular and of about equal size; the anterior tooth narrow, straight, directed obliquely forward, slightly widening toward the anterior end; the posterior tooth triangular; the space between them triangular and extending to the hinge. Interdentum rather long, narrow, rounded and parallel to the hinge. Two nearly straight, granular, lateral teeth, bent obliquely downward from the hinge line. Right valve with two pseudocardinal teeth, the anterior tooth small but well developed; the posterior tooth long and triangular, separated from the interdentum by a deep groove. One well developed lateral tooth, often with a parallel vestigial tooth below. Umbonal cavities rather shallow. Anterior and posterior muscle scars well impressed. Pallial line distinct. Nacre white.

Although the wide radial furrow of the male is usually a little deeper than in the female, the shells of the two sexes are essentially alike until they are about one-third grown. Then the female begins to develop a rounded, prolonged marsupial swelling, which points backward, almost at the middle of the ventral margin. The swelling is scarcely, if at all, radially sculptured, but it is thin, winglike and gapes slightly.

Length mm	Height mm	Width mm	
71	58	41	Wabash River, Indiana. Male.
76	68	41	As above. Female.
37	30	27	Holston River, Austins Grist Mill, Knox Co., Tennessee. Male.
51	49.5	25	Holston River, Tennessee. Female. Lectotype of *Truncilla lewisi*.

Anatomy. Known only from a brief description, based on an imperfect dry specimen, by Lea (1863, Jour. Acad. Nat. Sci. Phila. (2) 5: 443; 1863, Obs. Unio 10: 79).

Habitat. Call (1898: 511) observed that in the Ohio River this species was found on muddy bottoms in deeper water, while Stansbery (1970: 19) suggested that *flexuosa* was, "apparently a species of shallow riffles in big rivers," which it was in the Tennessee and Cumberland River systems.

Remarks. The pronounced sexual dimorphism shown in the shells of *Plagiola flexuosa* (Rafinesque), reflecting the special use of the gills as marsupia, make it one of the world's more remarkable species of Unionacea. It cannot be confused with any other member of the genus save *P. (E.) stewardsoni*, under which see *Remarks.* Walker described the form of *flexuosa* found in the Tennessee and Cumberland river systems as *lewisi* on the basis that the male of the latter did not grow as large or have a shell as heavy as that of the former. The female, he said, "besides being uniformly smaller, more delicate and smoother than [*flexuosa*], is especially characterized by the difference in the marsupial expansion, which is triangular and comparatively narrow at the extremity and of a different texture from the body of the shell [being thin and dark green]. In [*flexuosa*] this expansion is broadly rounded and is of the same texture as the remainder of the valve."

Truncilla lewisi is regarded here as merely an ecophenotypic variant. *Plagiola flexuosa* does not grow as large in the Tennessee and Cumberland river systems, where it lives on shallow riffles. It seems to have found in the muddy Ohio River, where it spread in post-glacial time, a favorable environment where it could achieve larger size. While Ohio River females do not usually have green marsupial swellings, one in the Museum of Comparative Zoology, no. 5358, does have the green marsupial swelling and is indistinguishable from females from the Tennessee and Cumberland river systems.

Specimens of *Plagiola flexuosa*, Museum of Comparative Zoology 221711, from the, "Ohio River, Stubenville, Ohio, C. M. Wheatley, 1856," and so labeled in the shells, extend the range of this species farther up the Ohio than was previously authenticated. While no specimens of this species have been found in the Kentucky,

Salt and Green rivers, since it was reported from them by Rafinesque, these localities fall within the known range of the species.

Range. Tennessee River system, Tennessee and Alabama; Cumberland River system, Kentucky; Ohio River system; from the lower Wabash River, Indiana to the Ohio River, Jefferson Co., Ohio.

Abundance. No collection has very many examples of this rare shell. Found sparingly in the Pickwick Basin mound deposits by Morrison (1942: 366). "Recorded from both the Tennessee and Cumberland River systems up until the construction of Wolf Creek Dam on the Cumberland [collected by Neel and Allen 1947–49] and the TVA Dams on the Tennessee. It has not been collected in over 20 years and hence is presumed extinct." (Stansbery, 1970, 19 as *lewisi*). Once locally abundant in the Ohio River, near Cincinnati, Hamilton County, Ohio. "This species has not been collected since 1900 [in the Ohio River] and is presumed extinct" (Stansbery, 1970: 19). Both *lewisi* and *flexuosa* are listed as "extirpated" by Stansbery (1976: 43, 50).

Specimens Examined

Tennessee River System

Powell River Drainage. *Tennessee*: Powell River, Combs, Claiborne Co. (CM, single male).

Clinch River Drainage. *Tennessee*: Clinch River (MCZ).

Holston River Drainage. *Tennessee*: Holston River, Holston Station, Grainger Co. (CM, single male); mouth of Holston River, Austins Grist Mill, Knox Co. (MCZ).

Tennessee River Drainage. *Alabama*: Tennessee River, Tuscumbia, Colbert Co. (USNM); Pickwick Basin, mounds between Barton, Colbert Co. and Waterloo, Lauderdale Co. (Morrison, USNM).

Cumberland River System

Cumberland River Drainage. *Kentucky*: Cumberland River, Port Burnside, Pulaski Co. (MZUM); Cumberland River, Rowena Ferry; Cumberland River, Long Bottom, just below Wolf Creek Dam, *both* Russell Co. (*both* MZUM).

Ohio River System

Wabash River Drainage. *Indiana*: White River (USNM); Wabash River (MCZ); Wabash River, New Harmony, Posey Co. (MZUM).

Green River Drainage. *Kentucky*: Green River (Rafinesque).

Salt River Drainage. *Kentucky*: Salt River (Rafinesque).

Kentucky River Drainage. *Kentucky*: Kentucky River (Rafinesque).

Ohio River Drainage. *Ohio*: Ohio River, Cincinnati, Hamilton Co. (MCZ). *Kentucky*: Fort Ancient Aspect. Campbell Co. [from Indian Midden] (USNM). *Ohio*: Ohio River, Steubenville, Jefferson Co. (MCZ).

Plagiola (*Epioblasma*) *stewardsoni* (Lea)

Plate 15, figures 9, 10
Distribution: Plate 8, figure C

Unio stewardsoni Lea, 1852, Trans. Amer. Philos. Soc. 10: 278, pl. 23, fig. 36 ([Tennessee] River, Chattanooga [Hamilton Co.], Tennessee; figured holotype ANSP 56572); 1852, Obs. Unio 5: 34.
Truncilla stewardsoni (Lea). Simpson, 1900, Proc. U. S. Natl. Mus. 22: 521; 1914, Cat. Naiades 1: 21. Ortmann, 1918, Proc. Amer. Philos. Soc. 57: 588.
Dysnomia (*Dysnomia*) *stewardsoni* (Lea). Ortmann, 1925, Amer. Mid. Nat. 32: 364. Frierson, 1927 Check list N American naiades, p. 93. Haas, 1969, Das Tierreich, pt. 88, p. 478.
Dysnomia stewardsoni (Lea). Morrison, 1942, Bur. Amer. Ethnology, Bull. no. 129, p. 365. Stansbery, 1970, Malacologia 10: 19, pl. 1, figs. 3, 4; 1971, Symposium of rare and endangered moll. U. S., p. 18a, figs. [8 as male of *lewisi*] 9, 10; Hurd, 1974, Ph.D. thesis, p. 97.

Description. Shell of small size, usually not exceeding 45 mm in length. Outline of shell irregularly rhomboid. Valves subequilateral, subcompressed, solid. Anterior end of the male shell regularly rounded forming an obtuse angle at its junction with the basal emargination. Anterior end of the female regularly rounded but becoming

straight and obliquely descending somewhat beyond the base line. Posterior end of the male subtruncated; that of the female slightly extended. Ventral margin of the male emarginate; female margin more considerably emarginate. Dorsal margin broadly curved in males; short and straight in females, forming an obtuse angle with the obliquely descending posterior margin. Hinge ligament prominent. Posterior ridge distinct and rounded, becoming slightly biangulate as it approaches the posterior end, where it terminates in a slight projection. Dorsal slope narrow and slightly concave. In front of a median groove there is a rounded anterior ridge that becomes somewhat pronounced as it approaches the base, where it terminates in a slight angle slightly backward, at, or a little behind, the middle of the ventral margin. In the female this anterior ridge becomes a produced, broadly rounded marsupial swelling. Umbos laterally compressed, only slightly elevated above the hinge line, located near the middle of the shell, their sculpture not observed. Surface of the shell with uneven concentric sculpture. Periostracum greenish yellow to brownish, with faint green rays. Marsupial expansion of the female sometimes dark and greenish.

Left valve with two ragged pseudocardinal teeth, triangular, and of about equal size; the anterior tooth narrow, straight, directed obliquely forward, slightly widening toward the anterior end; the posterior tooth triangular; the space between them triangular and extending to the hinge. Interdentum rather long, narrow, rounded, and parallel to the hinge. Two nearly straight, granular, lateral teeth, bent obliquely down from the hinge line. Right valve with two pseudocardinal teeth, the anterior tooth small and very slightly elevated above the hinge line, the posterior tooth long, high and triangular, separated from the interdentum by a groove. One well-developed lateral tooth, often with a parallel vestigial tooth below. Umbonal cavities rather shallow. Anterior and posterior adductor muscle scars well impressed. Pallial line distinct in males, distinct anteriorly only in females. Nacre white.

Although the wide radial furrow of the male being a very little bit deeper than in the female, the shells of the two sexes are essentially alike until they are about two-thirds grown. Then the female begins to develop a rounded, prolonged marsupial swelling which points backward, almost at the middle of the base. The swelling is often faintly radially sculptured, and is thin and winglike.

Length mm	Height mm	Width mm	
40	28	16	Holston River, Knoxville, Knox Co., Tennessee. Male.
32	27	16	As above. Female.
31	29	13	[Tennessee] River, Chattanooga [Hamilton Co.], Tennessee. Female. Holotype of *U. stewardsoni* Lea.

Remarks. Plagiola stewardsoni (Lea) and *flexuosa* are clearly sibling species. The former differs from *flexuosa* in several ways: It does not attain as large a size, the male shell is more quadrate, and the radial furrow is not as distinct or as deep. In the female of *stewardsoni*, the radial furrow is quite feeble and runs into the marsupial swelling, where it is generally obliterated, while in *flexuosa* the furrow continues to the base of the shell behind the marsupial swelling. The posterior ridge of *stewardsoni* is not produced posteriorly, which renders the ventral emargination proportionally more acute than in *flexuosa*. The marsupial swelling of *stewardsoni* is not as exaggerated as in *flexuosa*, but it also tends to be darker, often greenish, as in *flexuosa* specimens from the Tennessee and Cumberland river systems.

The two records listed by Hurd (1974: 97, 116) from the Coosa River drainage of the Mobile-Alabama-Coosa river system: "Coosa River, Al." (MZUM 90564) and "Etowah River, Ga." (MZUM 90565), as

suggested to Hurd by van der Schalie, are doubtless spurious.

Range. Restricted to the Tennessee and Cumberland river systems, Tennessee and Alabama.

Abundance. A rare species that has never been found in great numbers. This fact was noted by Ortmann (1918: 588) and by Morrison (1942: 365) who found it sparingly in the Pickwick Basin mound samples. "A rare species even before the impoundments and apparently not collected in the last half century. It is presumed extinct" (Stansbery, 1976: 43, 50).

Specimens Examined

Tennessee River System

Clinch River Drainage. *Tennessee*: Clinch River (MCZ); Clinch River, Clinton (CM); *both* Anderson Co.

Holston River Drainage. *Tennessee*: Holston River, Holston Station, Grainger Co.; Holston River, Mascot; Holston River, McMillan (*all* CM); mouth of Holston River, Austins Grist Mill (MCZ); *all* Knox Co.

French Broad River Drainage. *Tennessee*: Nolichucky River (MCZ).

Tennessee River Drainage. *Tennessee*: Tennessee River, Knoxville, Knox Co. (MCZ).

Little River Drainage. *Tennessee*: mouth of Little River, Little River Shoals, Blount Co. (MCZ).

Tennessee River Drainage. *Tennessee*: Tennessee River, Chattanooga, Hamilton Co. (Lea, USNM; MZUM). *Alabama*: Tennessee River, Bridgeport, Jackson Co. (MCZ); Tennessee River, Florence, Lauderdale Co.; Tennessee River, Tuscumbia, Colbert Co. (*both* USNM); Pickwick Basin, mounds between Barton, Colbert Co. and Waterloo, Lauderdale Co. (Morrison, USNM).

Cumberland River System

Cumberland River Drainage. *Kentucky*: Cumberland River, Pulaski Co. (MZUM). *Tennessee*: Cumberland River (USNM); Bartons Creek, Lebanon, Wilson Co. (MCZ).

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Plate 1.

The distribution of *Plagiola* (*Truncillopsis*) *triquetra* (Rafinesque).

This, the most primitive species of *Plagiola*, is the most widely distributed in the genus. It appears to have had refugia west of the Mississippi River beyond maximum Pleistocene glaciation (roughly to the Missouri River) on the Old Prairie and in the Meramec Basin, as well as in the upper White River system on the Ozark Plateau south of the Ozark Crest (record enclosed by large circle).

The occurrence of this species in the White River on the Ozark Plateau south of the Ozark Crest, as well as in the Tennessee and Cumberland river systems, including the Duck River drainage of the former, on the Cumberland Plateau, suggests that this species has persisted at least since the Cretaceous uplift. *P. triquetra* may also have had refugia in the Allegheny and Monongahela river drainages in the mountainous region of western Pennsylvania and West Virginia during the Pleistocene.

A. In post-glacial time *triquetra* spread into Wisconsin from a connection between the Fox and Wisconsin rivers in the vicinity of Portage, Columbia Co., Wisconsin.

B. The presence of *triquetra* in the Illinois River, Illinois and the Muskegon, Grand and St. Joseph rivers on the eastern side of Lake Michigan, suggests that before the formation of Lake Michigan the latter streams were tributaries of the Des Plaines River, which by way of the Chicago outlet drained into the Mississippi River, by way of the Illinois River.

C. The distribution of *triquetra* in the present rivers flowing into western and southern Lake Erie indicates they were part of the Greater Maumee River system, when the bed of Lake Erie was partially dry during the Trent outlet stage of the Great Lakes, and that there was a connection between the Wabash and Maumee rivers in the vicinity of Fort Wayne, Allen Co., Indiana.

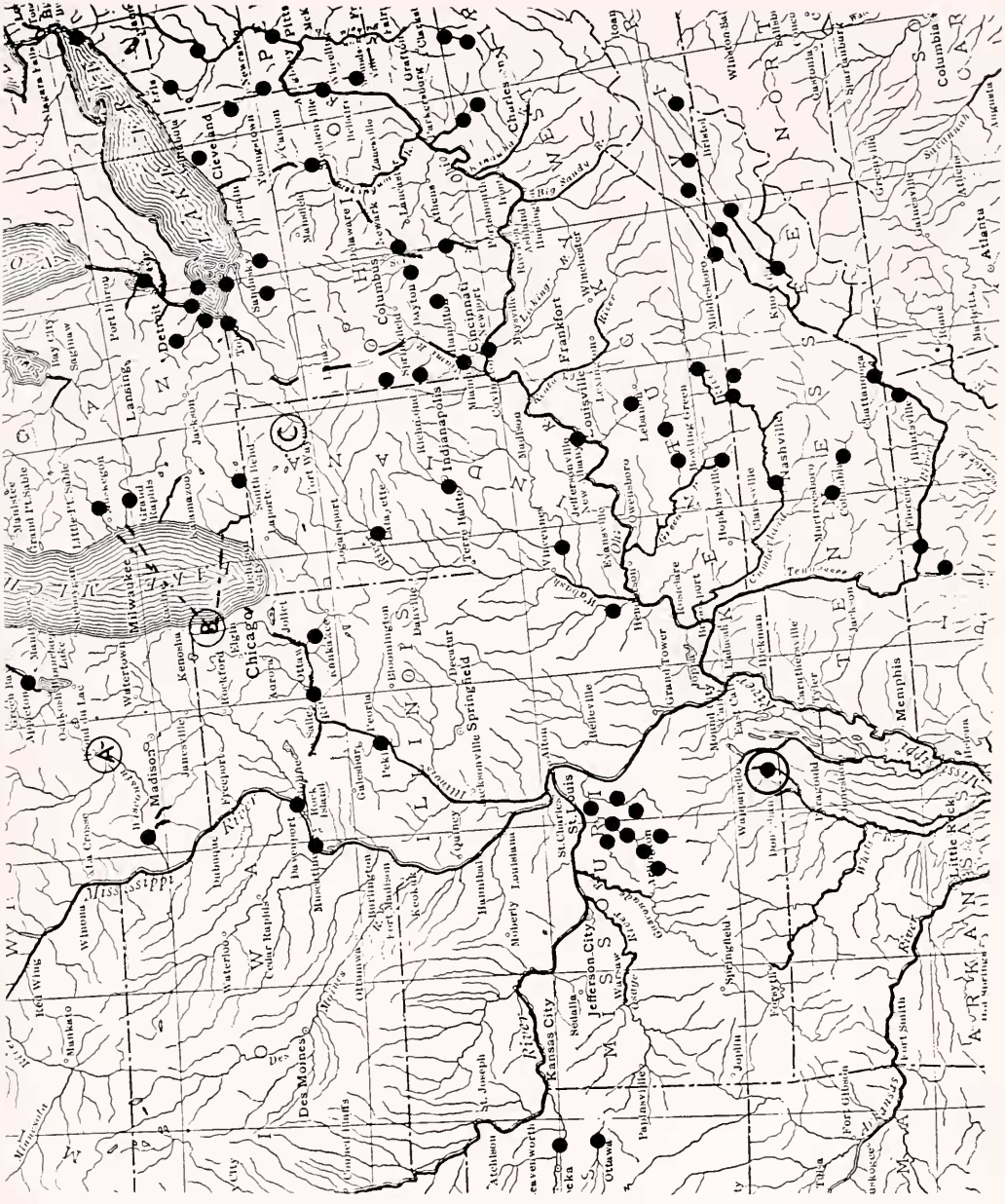
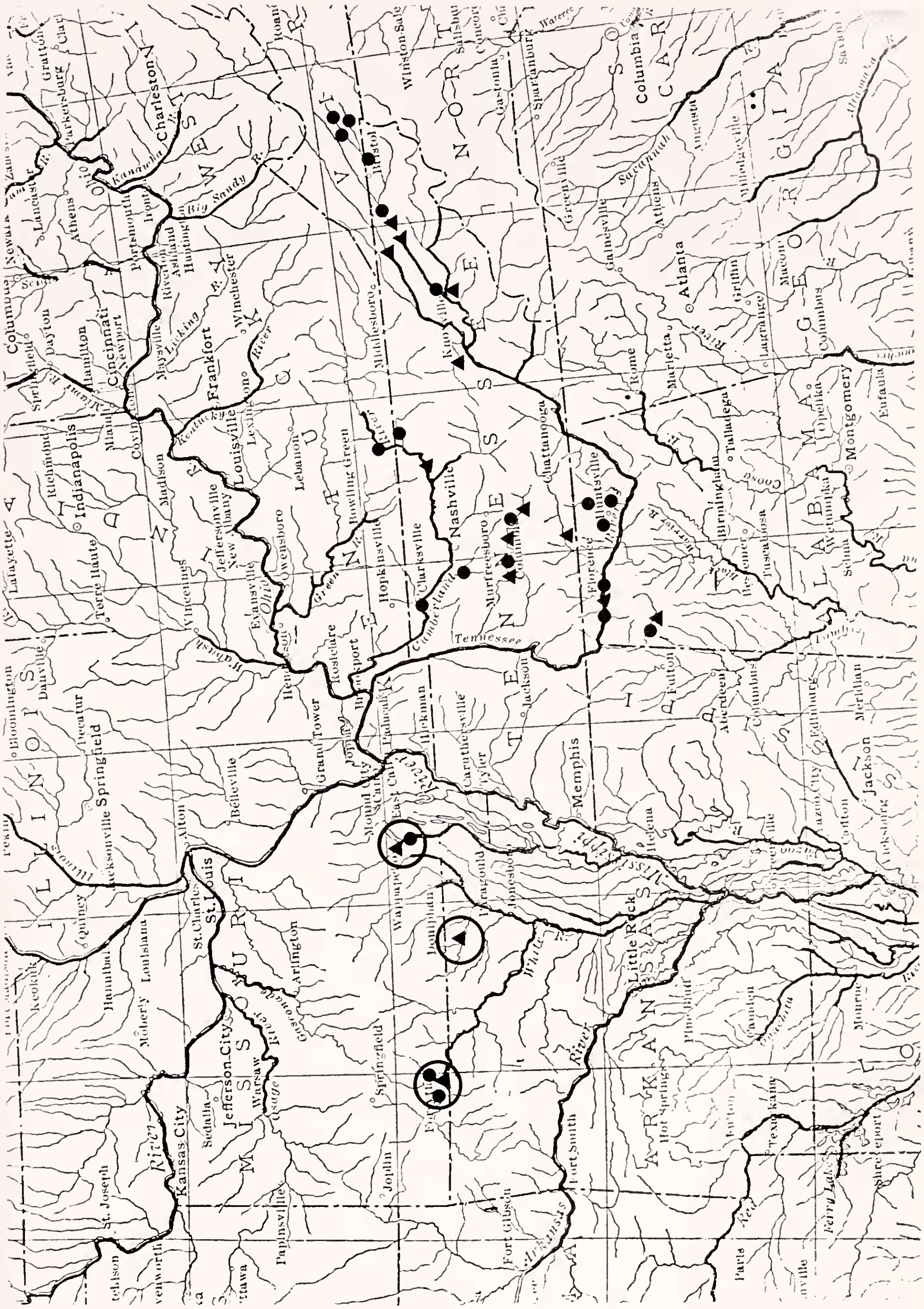

Chicago
Milwaukee
Madison
Detroit
Cleveland
Columbus
Cincinnati
Indianapolis
Springfield
Louisville
Nashville
Memphis
Atlanta
Kansas City
St. Louis
Des Moines
Omaha
Lansing
Toledo
Buffalo
Pittsburgh
Wheeling
Charleston
Frankfort
Little Rock
Fort Smith
Jefferson City
Columbia
Chattanooga
Knoxville
Lake Michigan
Lake Erie
Ohio River
Mississippi River
Missouri River
Illinois
Indiana
Ohio
Kentucky
Tennessee
Mississippi
Arkansas
Missouri
Iowa
Wisconsin
Michigan
West Virginia

Plate 2.

The distribution of *Plagiola* (*Torulosa*) *turgidula* (Lea) (triangles), and *Plagiola* (*Torulosa*) *florentina* (Lea) (dots).

The restricted distribution of *P. turgidula* and *florentina* to the upper White River system on the Ozark Plateau (records south of the Ozark Crest enclosed by large circles) and to the Tennessee and Cumberland river systems (including the Duck River drainage of the former) on the Cumberland Plateau, suggests that these species have persisted at least since the Cretaceous uplift.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Bowling Green
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Lexington
Cincinnati
Indianapolis
Columbus
Dayton
Charleston
Memphis
Jackson
St. Louis
Jefferson City
Kansas City
Springfield
Little Rock
Atlanta
Montgomery
Birmingham
Tuscaloosa
Columbia
Tennessee
Cumberland

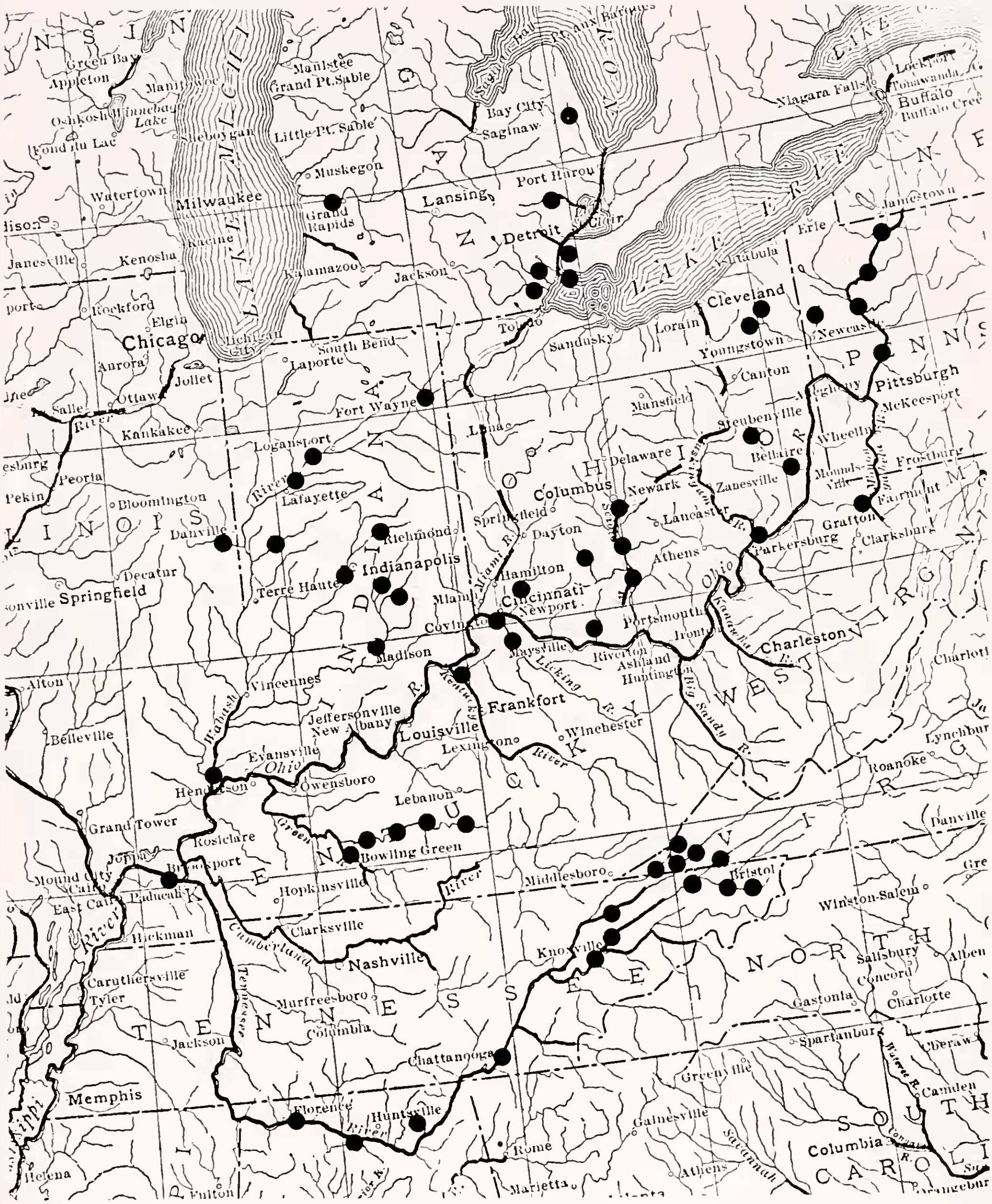
Plate 3.

The distribution of *Plagiola* (*Torulosa*) *torulosa* (Rafinesque).

This species has persisted in the Tennessee River system, and while it may have had refugia in the Green, Allegheny and Monongahela river drainages, it is assumed that it spread from the Tennessee River system in post-glacial time to form its present distribution.

Although not now found in any intervening rivers, it must have followed the same route as *triquetra* (Plate 1 B) in reaching the Grand River, Michigan.

Clearly it followed the same route as *triquetra* (Plate 1 C) in reaching lakes Huron and Erie.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Oshkosh
Winnebago Lake
Fond du Lac
Watertown
Manitowoc
Sheboygan
Milwaukee
Racine
Kenosha
Janesville
Rockford
Elgin
Chicago
Aurora
Joliet
Ottawa
La Salle
Kankakee
Peoria
Pekin
Bloomington
Danville
Decatur
Springfield
Alton
Belleville
Grand Tower
Mound City
Cairo
East Cairo
Paducah
Hickman
Caruthersville
Tyler
Jackson
Memphis
Helena
Fulton
Manistee
Grand Pt. Sable
Little Pt. Sable
Muskegon
Grand Rapids
Kalamazoo
Michigan City
South Bend
Laporte
Fort Wayne
Logansport
Lafayette
Terre Haute
Indianapolis
Richmond
Madison
Vincennes
Evansville
Ohio
Henderson
Owensboro
Jeffersonville
New Albany
Louisville
Lexington
Frankfort
Winchester
Lebanon
Bowling Green
Hopkinsville
Clarksville
Nashville
Murfreesboro
Columbia
Chattanooga
Florence
Huntsville
Rome
Marietta
Bay City
Saginaw
Port Huron
Lansing
Jackson
Detroit
Toledo
Sandusky
Lorain
Cleveland
Youngstown
Canton
Mansfield
Lima
Springfield
Dayton
Hamilton
Cincinnati
Newport
Covington
Maysville
Columbus
Delaware
Newark
Lancaster
Zanesville
Athens
Portsmouth
Ironton
Ashland
Huntington
Riverton
Steubenville
Bellaire
Wheeling
Moundsville
Parkersburg
Charleston
Clarksburg
Grafton
Fairmont
Frostburg
Pittsburgh
McKeesport
Newcastle
Erie
Jamestown
Buffalo
Niagara Falls
Lockport
Tonawanda
Middlesboro
Bristol
Knoxville
Roanoke
Lynchburg
Danville
Winston-Salem
Salisbury
Concord
Charlotte
Gastonia
Spartanburg
Greenville
Gainesville
Athens
Columbia
Camden
Cheraw
LAKE MICHIGAN
LAKE ERIE
INDIANA
OHIO
KENTUCKY
TENNESSEE
WEST VIRGINIA
NORTH
SOUTH CAROLINA

Plate 4.

The distribution of *Plagiola* (*Pilea*) *obliquata* (Rafinesque).

This species has persisted in the Tennessee and Cumberland river systems, and while it may have had a refugia in the Green River drainage, it is assumed that it spread from the former systems in post-glacial time to form its present distribution.

Clearly it followed the same route as *triquetra* (Plate 1 C) and *torulosa* (Plate 3) in reaching Lake Erie. Unlike the latter two species, which occur in the Allegheny and Monongahela river drainages, it is not known to have ascended the Ohio River beyond Cincinnati, Hamilton Co., Ohio, though like *P. flexuosa* (Plate 5), it probably did.


Manistee
Grand Pt. Sable
Bay City
Saginaw
Niagara Falls
Buffalo
Cheboygan
Little Pt. Sable
Muskegon
Milwaukee
Lansing
Port Huron
Grand Rapids
Detroit
Jamestown
Erie
Kalamazoo
Jackson
Cleveland
Chicago
Toledo
Sandusky
Lorain
Youngstown
Canton
Pittsburgh
South Bend
Laporte
Jollet
Fort Wayne
Mansfield
Steubenville
McKeesport
Logansport
Delaware
Wheeling
Lafayette
Columbus
Newark
Zanesville
Frostburg
Richmond
Springfield
Dayton
Lancaster
Indianapolis
Athens
Parkersburg
Grafton
Clarksburg
Terre Haute
Hamilton
Cincinnati
Newport
Portsmouth
Ironton
Charleston
Madison
Maysville
Riverton
Ashland
Huntington
Vincennes
Frankfort
Jeffersonville
New Albany
Louisville
Lexington
Winchester
Lynchburg
Evansville
Owensboro
Roanoke
Henderson
Lebanon
Tower
Rosiclare
Bowling Green
Danville
Middlesboro
Bristol
Hopkinsville
Winston-Salem
Clarksville
Knoxville
Nashville
Salisbury
Concord
Albemarle
Murfreesboro
Gastonia
Charlotte
Columbia
Spartanburg
Chattanooga
Greenville
Florence
Huntsville
Gainesville
Rome
Columbia
Athens

Plate 5.

The distribution of *Plagiola* (*Epioblasma*) *flexuosa* (Rafinesque).

This species has persisted in the Tennessee and Cumberland river systems; it is assumed that it spread from one or both of these systems in post-glacial time into the Ohio River system, where it occurs from the lower Wabash River drainage to the Ohio River, Steubenville, Jefferson Co., Ohio.


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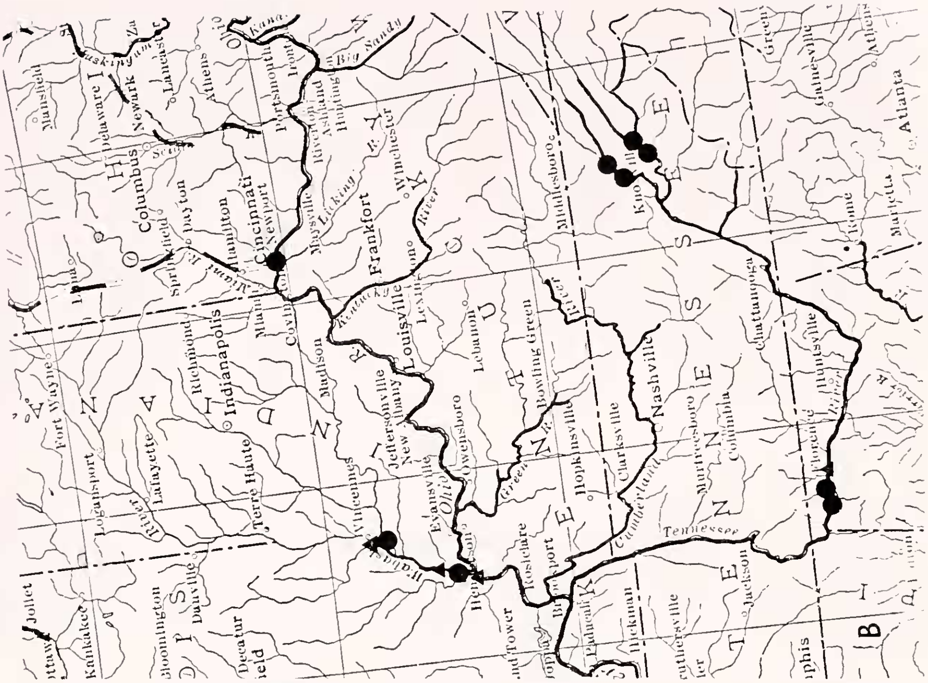
Detroit
Cleveland
Pittsburgh
Buffalo
Columbus
Indianapolis
Cincinnati
Louisville
Frankfort
Nashville
Knoxville
Chattanooga
Atlanta
Charleston
Columbia
Lansing
Toledo
Dayton
Lexington
Evansville
Owensboro
Vincennes
Terre Haute
Huntsville
Florence
Memphis
Wheeling
Parkersburg
Portsmouth
Maysville
Bowling Green
Clarksville
Hopkinsville
Lake Erie

Plate 6.

The distribution of *Plagiola* (*Pilea*) *personata* (Say), Fig. A, *Plagiola* (*Torulosa*) *propinqua* (Lea), Fig. B (dots), and *Plagiola* (*Torulosa*) *sampsoni* (Lea), Fig. B (triangles).

P. personata and *propinqua* have persisted in the Tennessee and Cumberland river systems, whereas *sampsoni* appears to be absent in the Cumberland. It is assumed that *sampsoni* spread from the Tennessee, while *personata* and *propinqua* spread from either or both the Tennessee and Cumberland river systems in post-glacial time, into the Ohio River system. They all occur in the lower Wabash River drainage, and extend in the Ohio drainage to Cincinnati, Hamilton Co., Ohio.

The location of *sampsoni* in the Tennessee River system is conjectural. An additional record, from the Ohio River at Cincinnati, is missing from the map.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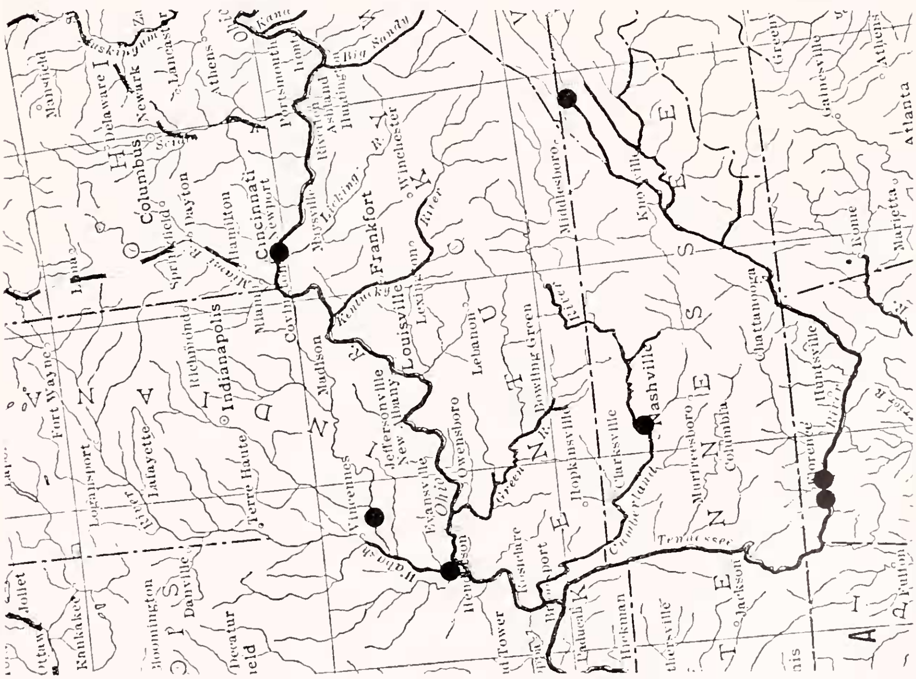
Louisville
Indianapolis
Nashville
Atlanta
Chattanooga
Tennessee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Louisville
Indianapolis
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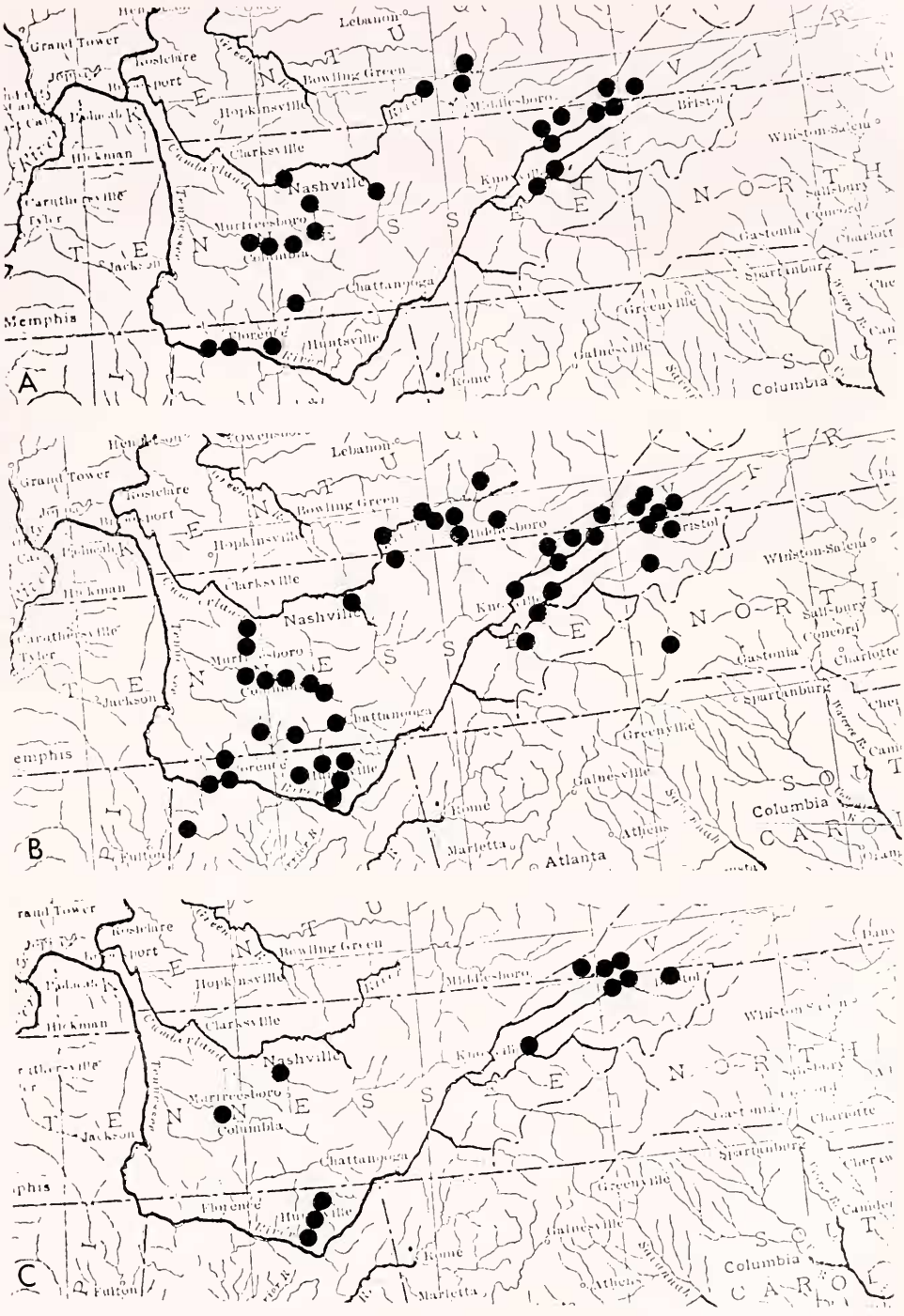
Atlanta
Chattanooga

Plate 7.

The distribution of *Plagiola* (*Plagiola*) *interrupta* (Rafinesque), Fig. A, *Plagiola* (*Torulosa*) *capsaeformis* (Lea), Fig. B, and *Plagiola* (*Plagiola*) *lenior* (Lea), Fig. C.

These species have persisted in the Tennessee and Cumberland river systems, and the Duck River drainage of the former. According to Ortmann (1924: 46), Duck River was originally more directly connected with the Tennessee and Cumberland rivers.

They did not extend their distribution in post-glacial time.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Murfreesboro
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Chattanooga
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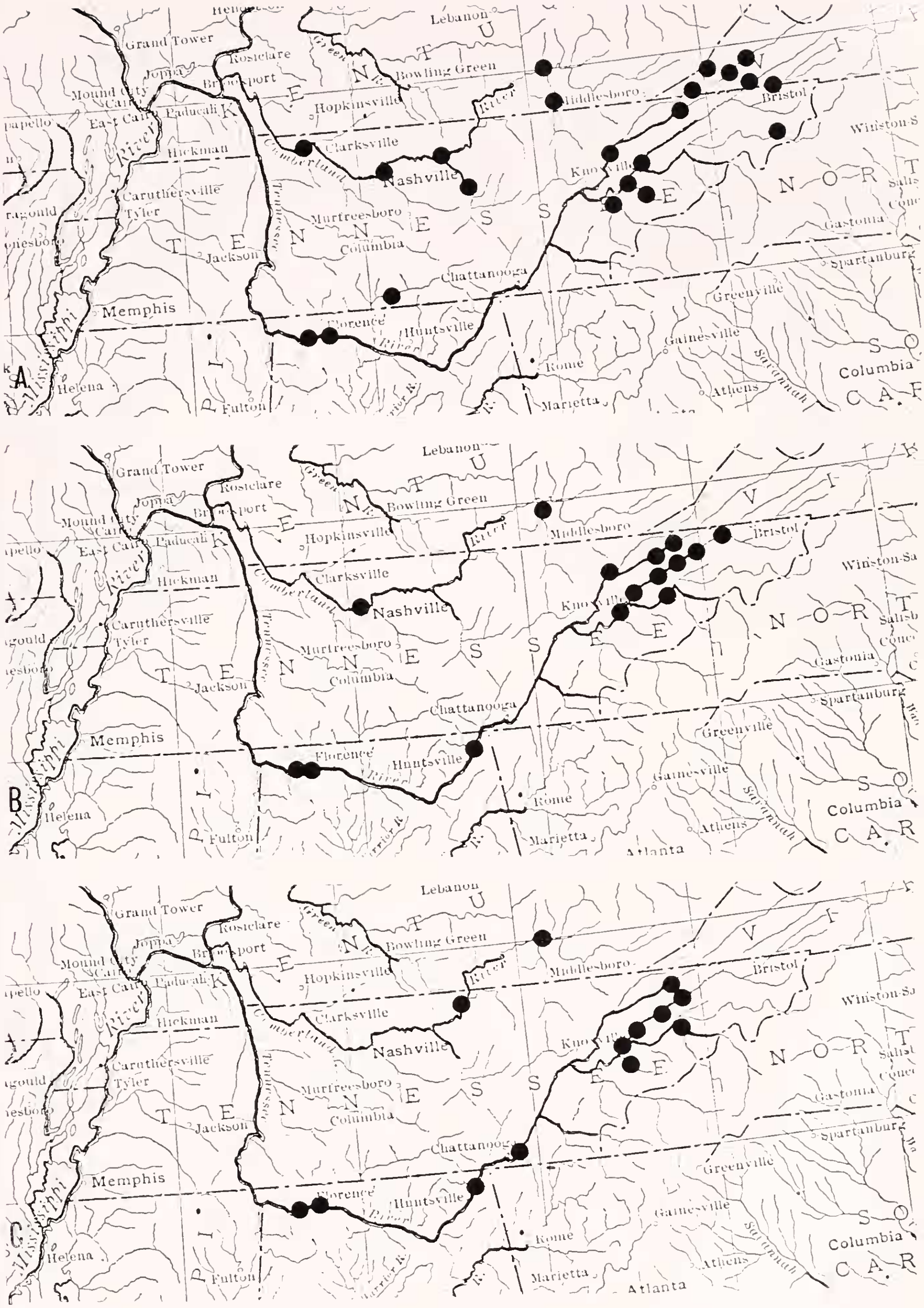
Bristol
Knoxville
Greeneville
Spartanburg
Gastonia
Charlotte
Salisbury
Concord
Winston-Salem
Greenville
Gainesville
Columbia
Atlanta
Athens
Marietta
Fulton

Plate 8.

The distribution of *Plagiola* (*Pilea*) *haysiana* (Lea), Fig. A, *Plagiola* (*Plagiola*) *arcaeformis* (Lea), Fig. B, and *Plagiola* (*Epioblasma*) *stewardsoni* (Lea), Fig. C.

These species have persisted in the upper and lower Tennessee River system as well as in the Cumberland River system. They did not extend their distribution in post-glacial time.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East Cairo
Paducah
Hopkinsville
Middlesboro
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Hickman
Clarksville
Cumberland
Nashville
Knoxville
Caruthersville
Tyler
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Gastonia
Jackson
Tennessee
Spartanburg
Chattanooga
Greenville
Memphis
Florence
Huntsville
River
Gainesville
Mississippi
Rome
Helena
Athens
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K E N T U
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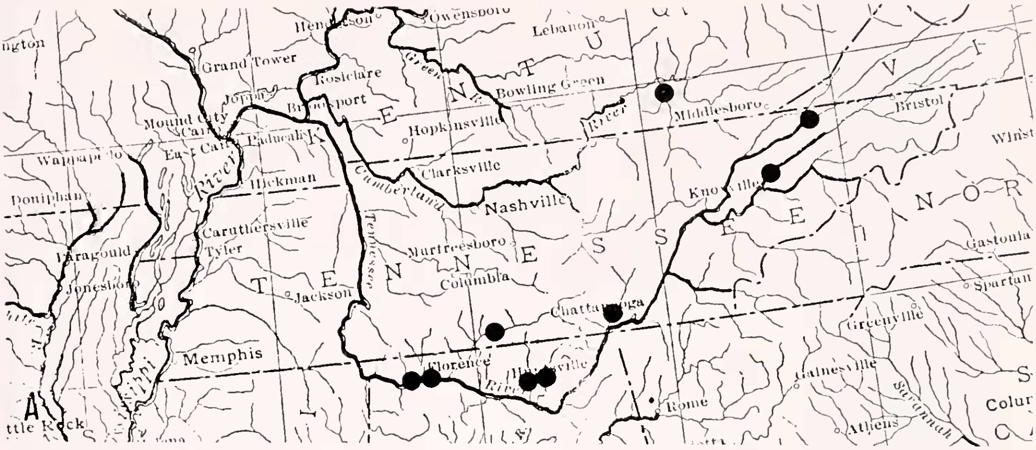
Plate 9.

The distribution of *Plagiola* (*Torulosa*) *biemarginata* (Lea), Fig. A, and *Plagiola* (*Plagiola*) *penita* (Conrad), Fig. B.

Figure A. *P.* (*T.*) *biemarginata* (Lea) has persisted in the upper and lower Tennessee River system and the Big South Fork of the Cumberland River. It, like the species shown on Plate 8, did not extend its distribution in post-glacial time.

Figure B. *P.* (*P.*) *penita* Conrad is restricted to the Alabama-Coosa River system and is clearly derived from *P.* (*P.*) *interrupta* (Rafinesque) of the Tennessee River system.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Greenville
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Paragould
Tyler
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Jackson
Murfreesboro
Columbia
Chattanooga
Memphis
Florence
Huntsville
Greenville
Gainesville
Little Rock
Helena
Fulton
Aberdeen
Columbus
Birmingham
Bessemer
Tuscaloosa
Talladega
Rome
Marietta
Atlanta
Athens
Augusta
Griffin
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Montgomery
Yazoo City
Edinburg
Canton
Jackson
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Vicksburg
Eufaula
Albany
Shubuta
Natchez
Hattiesburg
River Falls
Geneva
Thomasville
McComb
Baton Rouge
Gulfport
Mobile
Pensacola
Tallahassee
St. Marks
New Orleans
Morgan City
Mississippi Delta
Cape San Blas
Cape St. George
Cedar Keys
A L A B A M A
G E O R G I A
Alabama
Chattahoochee
Savannah
Mississippi

Plate 10.

Plagiola (*Truncillopsis*) *triquetra* (Rafinesque)

Figure 1. *Truncilla triqueter* Rafinesque. Falls of the Ohio River, [near Louisville, Jefferson Co., Kentucky]. Lectotype ANSP 20231. Length 55, height 37, width 25 mm. Male.

Figure 2. Green River, 8 mi. S Campbellsville, Taylor Co., Kentucky. MCZ 220157. Length 44, height 31, width 24 mm. Male.

Figure 3. Ohio River, Cincinnati, Hamilton Co., Ohio. MCZ 6158. Length 39, height 24, width 24 mm. Female.

Figure 4. Green River, 8 mi. S Campbellsville, Taylor Co., Kentucky. MCZ 220157. Length 36, height 24, width 22 mm. Female.

Plagiola (*Plagiola*) *interrupta* (Rafinesque)

Figure 5. *Obliquaria* (*Plagiola*) *interrupta* Rafinesque. [Cumberland River, Tennessee]. Lectotype ANSP 20257. Length 55.5, height 43, width 26.5 mm. Male.

Figure 6. *Unio brevidens* Lea. [Cumberland River, Tennessee]. Specimen subsequently identified by Lea USNM 85349. Length 54, height 38, width 23.5 mm. Male.

Figure 7. *Unio brevidens* Lea. [Cumberland River, Tennessee]. Specimen subsequently identified by Lea USNM 85349. Length 68, height 53.5, width 43.5 mm. Female.

Plagiola (*Plagiola*) *penita* (Conrad)

Figure 8. Coosa River, Weduska Shoals, Shelby Co., Alabama. MCZ 29817. Length 52, height 40, width 26 mm. Male.

Figure 9. *Unio penitus* Conrad. Alabama River, near Claiborne, Munroe Co., Alabama. Holotype ANSP 59860. Length 51, height 35, width 26 mm. Female.

Figure 10. *Unio metastriatus* Conrad. Black Warrior River, near Blount's Springs, Blount Co., Alabama. Length 30, height 23, width 17 mm. Syntype [lost], from Conrad. Male.

Figure 11. *Unio metastriatus* Conrad. Black Warrior River, near Blount's Springs, Blount Co., Alabama. Length 28, height 21 mm, width unavailable. Syntype [lost], from Conrad. Female.

Figure 12. *Unio compactus* Lea. Etowah River, Georgia. Holotype USNM 84447. Length 32, height 27, width 19 mm. Male.

Figure 13. *Unio compactus* Lea. Etowah River, Georgia. Allotype USNM 84447a. Length 28, height 20, width 16 mm. Female.

Figure 14. *Unio modicellus* Lea. Connasauga River, Georgia. Holotype USNM 84841. Length 28, height 21, width 15 mm. Male.

Figure 15. *Unio othcaloogensis* Lea. Oothkalooga Creek, Gordon Co., Georgia. Holotype USNM 84615. Length 22, height 16, width 13 mm. Male.

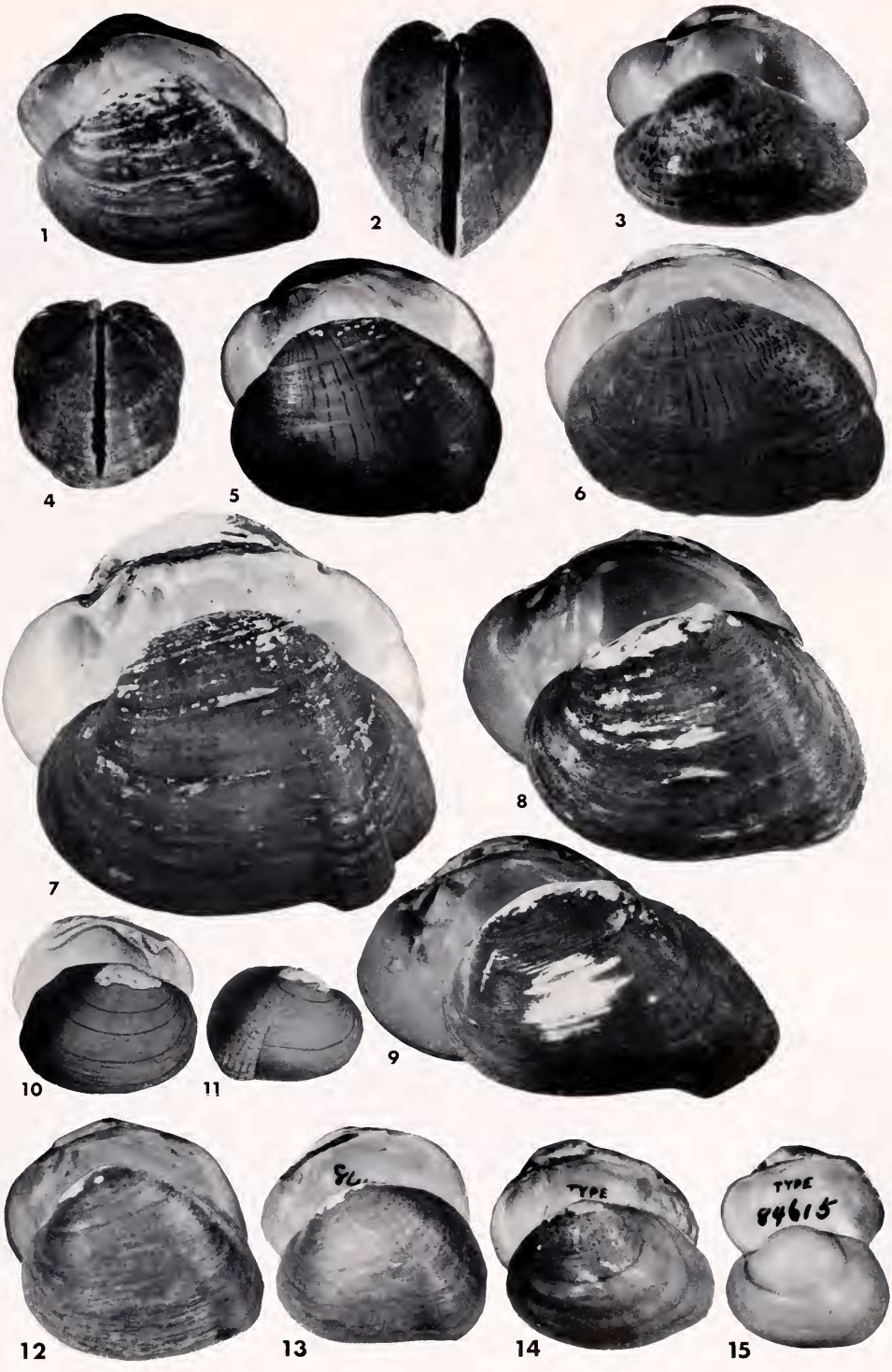
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Plate 11.

Plagiola (*Plagiola*) *arcaeformis* (Lea).

Figure 1. *Unio arcaeformis* Lea. Tennessee River, Florence, Lauderdale Co., Alabama. Specimen subsequently identified by Lea USNM 84422. Length 54.5, height 43.5, width 38 mm. Male.

Figure 2. Cumberland River, Tennessee. MCZ 5033. Length 42, height 34, width 27 mm. Male.

Figure 3. Cumberland River, Tennessee. MCZ 5033. Length 55, height 40, width 40 mm. Female.

Figure 4. *Unio arcaeformis* Lea. Tennessee River, Florence, Lauderdale Co., Alabama. Specimen subsequently identified by Lea USNM 84422. Length 56.5, height 39, width 39 mm. Female.

Plagiola (*Plagiola*) *lenior* (Lea)

Figure 5. Eastern Tennessee. MCZ 16387. Length 35, height 21, width 14 mm. Male.

Figure 6. *Unio lenior* Lea. Stones River, Tennessee. Holotype USNM 86130. Length 25, height 16, width 12.5 mm. Female.

Plagiola (*Torulosa*) *torulosa* (Rafinesque)

Figure 7. *Amblema gibbosa* Rafinesque. Ohio River. Lectotype ANSP 20232. Length 40, height 33, width 25 mm. Male.

Figure 8. *Unio perplexus* Lea. Ohio River, Cincinnati, Hamilton Co., Ohio. Holotype USNM 84324. Length 64, height 43, width 32.5 mm. Male.

Figure 9. *Unio cincinnatiensis* Lea. Ohio River, Cincinnati, Hamilton Co., Ohio. Holotype USNM 84199. Length 48, height 39, width 27.5 mm. Male.

Figure 10. *Unio rangianus* Lea. Mahoning River, near Poland, Mahoning Co., Ohio. Allotype USNM 84798. Length 51.5, height 36, width 26 mm. Male.

Figure 11. *Truncilla sulcata delicata* Simpson. Detroit River. Amherstburg, Essex Co., Ontario. Holotype USNM 160853. Length 44, height 31, width 24 mm. Male.

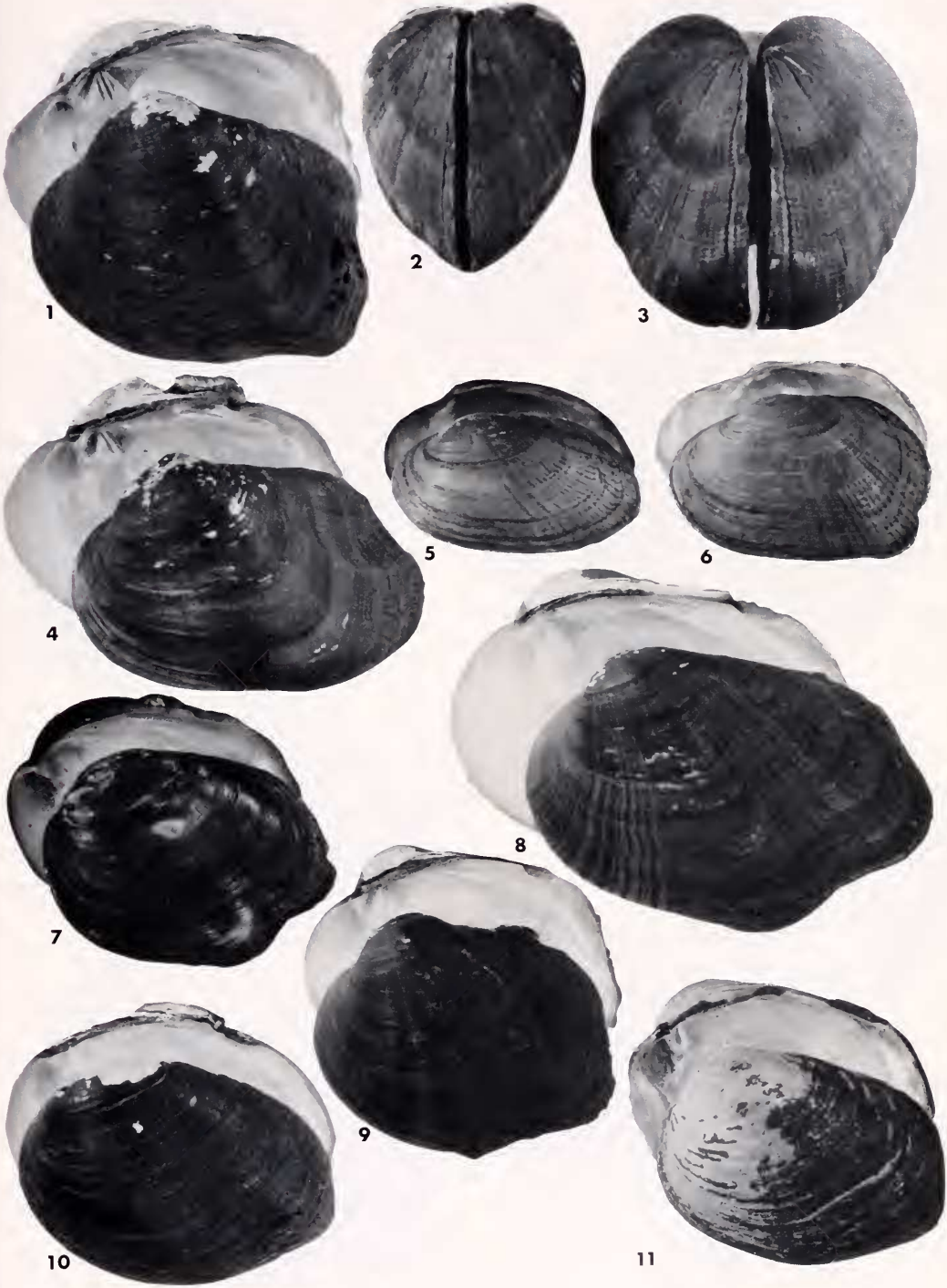
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Plate 12.

Plagiola (*Torulosa*) *torulosa* (Rafinesque)

Figure 1. *Amblema torulosa* Rafinesque. Kentucky River, Kentucky. Holotype ANSP 20218. Length 65, height 48, width 33.5 mm. Female.

Figure 2. *Unio rangianus* Lea. Mahoning River, near Poland, Mahoning Co., Ohio. Lectotype USNM 84798. Length 49, height 35.5, width 24 mm. Female. [Slightly larger than Lea's figured type].

Figure 3. *Unio gibbosus perobliquus* Conrad. Wabash River, Indiana. Figured type [lost] from Conrad. Length 56, height 48, width 32 mm. Male.

Figure 4. *Unio phillipsii* Reeve. North America. Length 54, height 45, width 30 mm. Holotype BMNH 196481. Female.

Figure 5. *Unio gubernaculum* Reeve. (Hab?). Holotype BMNH 1965203. Length 57, height 48, width 19 mm. Female.

Plagiola (*Torulosa*) *sampsoni* (Lea)

Figure 6. *Unio sampsonii* Lea. Wabash River, New Harmony, Posey Co., Indiana. Holotype USNM 84802. Length 42.5, height 33, width 25.5 mm. Male.

Figure 7. *Unio sampsonii* Lea. Wabash River, New Harmony, Posey Co., Indiana. Allotype USNM 84802. Length 45, height 38.5, width 29 mm. Female.

Plagiola (*Torulosa*) *propinqua* (Lea)

Figure 8. *Unio propinquus* Lea. Tennessee River, Florence, Lauderdale Co., Alabama. Holotype USNM 84332. Length 53, height 41, width 33 mm. Male.

Figure 9. Holston River, Knoxville, Knox Co., Tennessee. MCZ 5819. Length 44, height 46, width 31 mm. Female.


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Plate 13.

Plagiola (*Torulosa*) *biemarginata* (Lea)

Figure 1. *Unio biemarginatus* Lea. Tennessee River, Florence, Lauderdale Co., Alabama. Allotype USNM 84608a. Length 38.5, height 30, width 19 mm. Male.

Figure 2. *Unio biemarginatus* Lea. Tennessee River, Florence, Lauderdale Co., Alabama. Holotype USNM 84608. Length 36, height 31.5, width 18 mm. Female.

Plagiola (*Torulosa*) *capsaeformis* (Lea)

Figure 3. *Unio capsaeformis* Lea. Cumberland River, Tennessee. Holotype MCZ 178570. Length 45, height 33, width 24 mm. Male.

Figure 4. *Unio capsaeformis* Lea. Cumberland River, Tennessee. Specimen subsequently identified by Lea MCZ 178568. Length 43, height 30, width 18 mm. Female.

Plagiola (*Torulosa*) *florentina* (Lea)

Figure 5. *Unio florentinus* Lea. Tennessee River, Florence, Lauderdale Co., Alabama. Allotype USNM 84948. Length 36, width 27, height 20 mm. Male.

Figure 6. *Truncilla walkeri* Wilson and Clark. East Fork of Stones River, near Walterhill, Rutherford Co., Tennessee. Paralectotype MZUM 90729. Length 47, height 34, width 22 mm. Male.

Figure 7. *Truncilla curtisii* Frierson and Utterback. White River, Forsyth, Taney Co., Missouri. Paralectotype MZUM 90748. Length 35, height 26, width 19 mm. Male.

Figure 8. *Unio florentinus* Lea. Tennessee River, Florence, Lauderdale Co., Alabama. Holotype USNM 84948. Length 33, height 27, width 19 mm. Female.

Figure 9. *Truncilla walkeri* Wilson and Clark. East Fork of Stones River, Walterhill, Rutherford Co., Tennessee. Lectotype MZUM 90729. Length 42, height 30, width 17 mm. Female.

Figure 10. *Truncilla curtisii* Frierson and Utterback. White River, Forsyth, Taney Co., Missouri. Lectotype MZUM 90748. Length 32, height 27, width 17 mm. Female.

Figure 11. Black River, Hendrickson, Butler Co., Missouri. MCZ 260979. Length 26, height 21, width 13 mm. Female.

Figure 12. *Unio sacculus* Anthony. Tennessee. Holotype MCZ 161898. Length 33, height 24, width 16 mm. Female.

Figure 13. *Truncilla curtisii* Frierson and Utterback. White River, Hollister, Taney Co., Missouri. Figured syntype [lost] from Utterback. Length 33, height 23, width 15 mm. Female.

Figure 14. *Truncilla curtisii* Frierson and Utterback. White River, Hollister, Taney Co., Missouri. Figured syntype [lost] from Utterback. Length 22.5, height 19.5, width 13.5 mm. Male.


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Plate 14.

Plagiola (*Torulosa*) *turgidula* (Lea)

Figure 1. *Truncilla lefevrei* Utterback. Black River, Williamsville, Wayne Co., Missouri. Figured syntype [lost] from Utterback. Length 32, height 21, width 15 mm. Female.

Figure 2. *Truncilla lefeveri* Utterback. Black River, Williamsville, Wayne Co., Missouri. Figured syntype [lost] from Utterback. Length 26.5, height 18, width 14 mm. Male.

Figure 3. *Unio turgidulus* Lea. Cumberland River, Tennessee. Holotype USNM 84946. Length 41.5, height 30, width 23.5 mm. Male.

Figure 4. Spring Creek, Hardy, Sharp Co., Arkansas. MZUM 90742. Length 40, height 29, width 17 mm. Male.

Figure 5. *Unio deviatus* Anthony. Tennessee. Holotype MCZ 161895. Length 39, height 25, width 19 mm. Female.

Figure 6. Spring Creek, Hardy, Sharp Co., Arkansas. MZUM 90742. Length 33, height 24, width 15 mm. Female.

Plagiola (*Pilea*) *personata* (Say)

Figure 7. *Unio pileus* Lea. Ohio River, near Cincinnati, Hamilton Co., Ohio. Holotype USNM 84602a. Length 47, height 43, width 28 mm. Male.

Figure 8. *Unio capillaris* Lea. Ohio. Specimen subsequently identified by Lea USNM 84602. Length 54, height 46, width 33 mm. Female.

Figure 9. *Unio personatus* Say. Cumberland River, Tennessee. Neotype MCZ 5763. Length 54, height 48, width 31 mm. Female.

Plagiola (*Pilea*) *obliquata* (Rafinesque)

Figure 10. *Obliquaria obliquata* Rafinesque. Kentucky River. Lectotype ANSP 20226. Length 59, height 43, width 32.5 mm. Male.

Figure 11. *Unio sulcatus* Lea. Ohio. Holotype USNM 84803. Length 57, height 41, width 33 mm. Male.

Figure 12. *Unio sulcatus* Lea. Ohio. Allotype USNM 84803. Length 37, height 29.5, width 23 mm. Female.

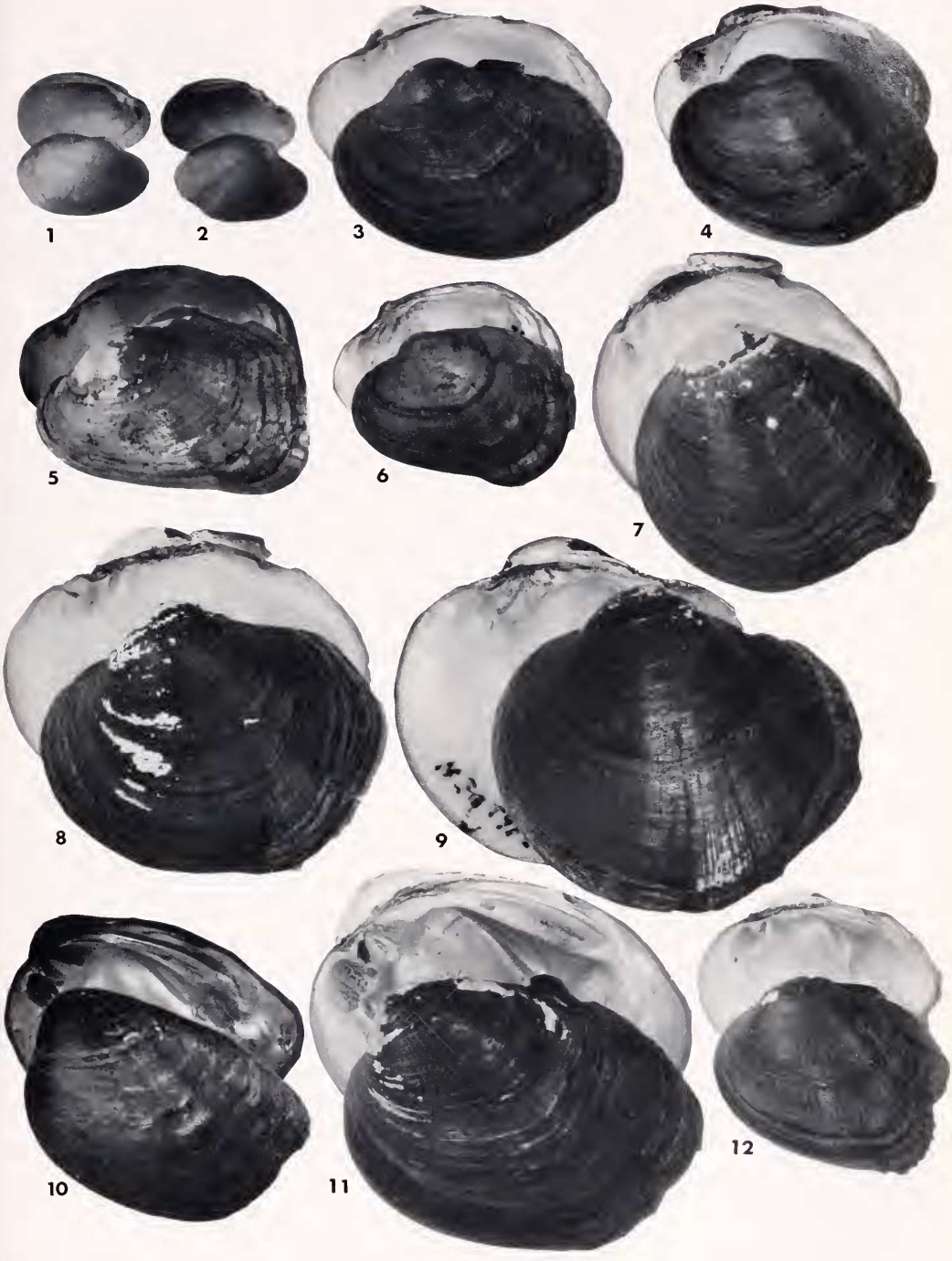
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Plate 15.

Plagiola (*Pilea*) *haysiana* (Lea)

Figure 1. *Unio haysianus* Lea. Cumberland River, Nashville, Davidson Co., Tennessee. Specimen subsequently identified by Lea USNM 84613. Length 51.5, height 49, width 36 mm. Male.

Figure 2. *Unio sowerbyanus* Lea. Caney Fork of the Cumberland River, Tennessee. Specimen subsequently identified by Lea MCZ 178686. Length 39, height 38, width 28 mm. Male.

Figure 3. Cumberland River, Tennessee. MCZ 5451. Length 32, height 30, width 28 mm. Female.

Figure 4. *Unio haysianus* Lea. Cumberland River, Nashville, Davidson Co., Tennessee. Specimen subsequently identified by Lea USNM 84613. Length 25.5, height 24.5, width 19 mm. Female.

Plagiola (*Epioblasma*) *flexuosa* (Rafinesque)

Figure 5. *Obliquaria flexuosa* Rafinesque. Kentucky River. Lectotype ANSP 20249. Length 57, height 47, width 33 mm. Male.

Figure 6. *Truncilla lewisi* Walker. Holston River, Tennessee. Paralectotype MZUM 91456. Length 43, height 37, width 22.5 mm. Male.

Figure 7. *Epioblasma biloba* Rafinesque. Ohio River, Cincinnati, Hamilton Co., Ohio. Neotype ANSP 56571. Length 65, height 59, width 40 mm. Female.

Figure 8. *Truncilla lewisi* Walker. Holston River, Tennessee. Lectotype MZUM 91456. Length 51, height 49.5, width 25 mm. Female.

Plagiola (*Epioblasma*) *stewardsoni* (Lea)

Figure 9. *Unio stewardsoni* Lea. Tennessee. Specimen subsequently identified by Lea MCZ 178817. Length 31, height 29, width 18 mm. Male.

Figure 10. *Unio stewardsoni* Lea. Tennessee River, Chattanooga [Hamilton Co.], Tennessee. Holotype ANSP 56572. Length 31, height 29, width 13 mm. Female.


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